Volume 144, No. 4 March, 1957

WORLD OIL

Established 1916 as The OIL WEEKLY

CURRENT OUTLOOK SECTION

		Page
Looking Ahead		57
Editor's Page	Warren L. Baker	61
Oil Demand in Western Europe to Be Strong in Next 20 Years	G. P. Glass and J. H. D. Page	62
U. S. Is Not Running Out of Oil	Richard J. Gonzalez	64
If Oil Could Speak		69
Computers Solve Production Problems	David Rubinfien and Ralph F. Lewis	70
How to Prevent Crude Oil Tank Fires (Part 2)	J. L. Risinger	78
CHANGING PANORAMA: Free Oil Industry Spends $56 Billion in 10 Years	Frederick G. Coqueron and Joseph E. Pogue	82
Report from Observatory	Ray L. Dudley and Warren L. Baker	84
Petroleum Trends		84
Drilling Activities	Cecil W. Smith	70

EXPLORATION SECTION

Bisti-Black Rock Is Important San Juan Basin Find		90
Aneth Significant Paradox Basin Strike		92
Texas Panhandle Paleogeology (Part 2)	Robert I. Roth	94
Major Oil Field Is Seen in Citronelle Structure	Walter B. Jones and Winnie McGlamery	99

DRILLING SECTION

Air Drilling in Texas Panhandle	R. L. Knight	106
Fishing Tools and Techniques (Part 2)—Interspersed Carbide	Weldon L. Medders	110
Hazards on the Rig Floor	R. G. Archibald	124
Selecting Drill Collar Length by Pressure Method	D. M. Best	140

PRODUCTION SECTION

Should We Use Bullets or Jets?	Jake Lebus	149
Retarded Acid Is Successful in Alberta	Harry R. Gryzen	154
Electrification Pays Off	William L. Boosa	159
Making Temperature Talk	John Disch	164
Unusual Operating Problems a Feature of Koogler Water-Flood in Kansas	S. S. Mabry	172

INTERNATIONAL SECTION

$50 Million Oil Sands Project Scheduled		183
A WORLD OIL Interview: Indian Minister Evaluates Oil	Don Kliewer	185
British Petroleum Stepping Up Search for Oil		186
Northeastern Bolivia Offers Good Oil Possibilities	Victor Oppenheim	188
Suez Action Is Hard Blow to Italian Oil Industry	Antonio Giordano	192
Panama Activity Accelerated by Costa Rican Discovery	E. A. Koester	194
What's Happening Among World Oil Men		202

DEPARTMENTS

Who's Meeting Where	54
Drilling Hints	204
Production Hints	214
What's Happening Among Men in the Industry	226
Deaths	234
Companies in the News	236
Associations	238
What's Happening Among Service and Supply Men	240
Trading Post	258
Classified Advertising Page	258
Squeaks from the Bullwheel	262

NEW EQUIPMENT SECTION

What's New in Equipment	268
New Equipment Catalogs and Literature	277
ADVERTISER'S INDEX	278

a quick look at WORLD OIL this month

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following pages, checking ☑ those you want to read first.

CURRENT OUTLOOK

☐ **The next two months** are an extremely important period for the U. S. oil industry. They will pretty well determine whether U. S. crude and product prices are likely to hold at their new higher levels or undergo reductions. All depends on refinery output of gasoline. Other conditions are favorable. Vastly improved outlook can be achieved if refinery crude runs and gasoline yields are held to reduced levels of recent weeks. See **Page 84. Next 60 Days Key to Price Outlook**. . **Ray L. Dudley and Warren L. Baker**

☐ **Western Europe's consumption of Petroleum** is expected to increase about 5½ percent annually in the next 20 years. This growth is indicated by economic prospects in the major countries of the region. Total energy use will expand about 2.6 percent annually. Hydro-electric power consumption will continue to increase substantially. But coal will supply a decreasing percentage of total energy used. Nuclear power may supply at least 6 percent of energy demand by 1975. The remainder of energy requirements will be met by petroleum fuels and natural gas. The demand for those fuels can be expected to grow by 5½ percent annually. See **Page 62. Oil Demand in Western Europe To Be Strong In Next 20 Years**. . . . . **G. P. Glass and J. H. D. Page**

Turn the Page ▸

THIS MONTH . . .

☐ **The U. S. is not running out of oil,** as many have warned. It is not essential to curtail consumption of domestic petroleum or to use more foreign oil in order to conserve U. S. reserves. New oil is being developed in the U. S. at an increasing rate. Current levels of operations will result in further increases in oil finding. Recent estimates of ultimate production will prove conservative because of improved producing techniques and additional discoveries in new and old provinces. The U. S. will have sufficient petroleum for its future progress if taxes are kept reasonable and imports are soundly handled. Reasonable imports will stimulate efficiency in domestic operations. But excessive imports will do damage to progress and security. See **Page 64. U. S. Not Running Out of Oil**..... **Richard I. Gonzalez**

☐ **How can computers aid in production?** What are the current purchase and rental costs of computing equipment? Answers to these timely questions, plus two case histories showing how to set up a computing program in your company are presented in this comprehensive report. For full details on the growing use for computers in production, see **Page 70. Computers Solve Production Problems**...**David Rubenfien and Ralph F. Lewis**

☐ **Safety and Fire Protection (Part 2)**—The second article of this timely series covers the many aspects of crude oil tank fire prevention. For a thorough analysis of the proper use of flame arresters, prevention of boilover and slopover, safeguards against lightning ignition—as discussed by one of the nation's top fire protection experts, turn to **Page 78. How to Prevent Crude Oil Tank Fires**.....**J. L. Risinger**

☐ **The petroleum industry of the Free World** has carried out large and costly expansion and replacement of facilities since the war. In 10 postwar years it made capital expenditures totaling $56 billion. About two thirds of the total was spent in the U. S. and one third in other free countries. Of the total about 59 percent was spent for production department facilities, 16 percent for refining, 13 percent for transportation and 12 percent for marketing. Gross investment in fixed assets consequently grew to $63 billion at the end of 1955 from $23 billion at the close of 1945. The expansion was made to take care of a doubling of Free World petroleum consumption—to 14.4 million barrels per day in 1955 from 7.1 million daily in 1946. See **Page 82. $56 Billion Capital Expenditures Made by Free World Oil Industry in 10 years . . . Frederick G. Coqueron and Joseph E. Pogue**

EXPLORATION ARTICLES

☐ **For a look at recent developments** in the San Juan Basin, turn to **Bisti-Black Rock Is Important San Juan Basin Find**.....**Page 90**

☐ **The Aneth area** of southeast Utah will probably be tagged as the most important Rocky Mountain discovery for 1956. For further details of this area, see **Aneth Significant Paradox Basin Strike**.....**Page 92**

☐ **Part 2 of the article** covering research on the paleogeology of the Texas Panhandle continues from a Pre-Pennsylvanian to a Pennsylvanian study of the area in question. Complete descriptions of the Bend, Strawn, Canyon, Cisco and other important Pennsylvanian horizons penetrated in the Panhandle area are included. See **Page 94, Texas Panhandle Paleogeology**..... **Robert I. Roth**

☐ **Activity continues in the Citronelle field** of Alabama and from all indications, the future looks promising for the area. For a resume of activity plus geology of the area, see **Page 99, Major Oil Field Is Seen in Citronelle Structure**.....**Walter B. Jones and Winnie McGlamery**

DRILLING ARTICLES

☐ **Air drilling is still** not the solution to drilling problems in the Panhandle field. However, where it is possible to use this method, contractors are cutting five bits off the 2800 foot wells and effecting an over-all savings of $1600. For more on the limitations and advantages of this method turn to **Page 106, Air Drilling in the Texas Panhandle**.....**R. L. Knight**

☐ **Fractured carbides bonded** to cutting heads and shoes with a special matrix have greatly increased burning and cutting operations. How and why they are used and some of the amazing field results are presented on **Page 110** in this second article on **Fishing Tools and Techniques (Part 2)—Interspersed Carbides**..... **Weldon L. Medders**

☐ **The rig floor**—where most of the drilling work takes place—is the scene of countless accidents each year. Some are slight and some are fatal. Eighteen of the

WORLD OIL, published every month except semi-monthly in February and August. Entered as THE OIL WEEKLY as second class mail matter December 23, 1916, at postoffice at Houston, Texas, under the act of March 3, 1879.

danger areas are highlighted in this article. How does your present safety program measure up to the one described on **Page 124, Hazards on the Rig Floor**..... **R. G. Archibald**

☐ **Consider the effect of buoyancy** and the weight of the drilling fluid displaced when calculating drill collar requirements. A new concept of figuring the amount of weighted collars is presented on **Page 140. See Selecting Drill Collar Length by Pressure Method**..**D. M. Best**

PRODUCTION ARTICLES

☐ **Effective perforating** is an important part of a good completion program. To get the best possible job, take advantage of the outstanding features of both jets and bullets. What are these features? When should they be used? For details turn to **Page 149** and read **Should We Use Bullets or Jets?**.....**Jake H. Lebus**

☐ **A Newly developed retarded acid** is providing deeper penetration and as a result, greater drainage area in limestone and dolomite formations. Case histories from the Leduc and Redwater Fields in Alberta, Canada show the effectiveness of this compound. See **Page 154, Retarded Acid Is Successful in Alberta**.**Harry R. Gryzen**

☐ **Increased production and reduced expenses** were the result of the Cities Service Oil Company's electrification program in the Pampa, Texas, area. For a close look at the economic advantages, turn to **Page 159. Electrification Pays Off**.....**William L. Boosa**

☐ **A super-sensitive temperature survey** method is proving to be a time and money saving production tool. Actual case histories indicate the effectiveness of this instrument in a variety of applications. Turn to **Page 164** for details on **Making Temperatures Talk**..... **John Disch**

☐ **Two widely-different types** of reservoir rock plus an extensive air drive have combined to present some unusual operating problems in the Koogler secondary recovery project in the El Dorado Field, Kansas. These are described on **Page 172** in the article: **Unusual Operating Problems a Feature of The Koogler Waterflood in Kansas**.....**S. S. Mabry**

INTERNATIONAL ARTICLES

☐ **Alberta's Athabasca oil sands** contain crude reserves estimated at between 100 and 300 billion barrels, but until now the problem has been to separate the oil and to move it to market at a profit. Royalite Oil Company has scheduled a $50 million project aimed at extracting the crude with a centrifuge process and moving 20,000 barrels of oil a day to market by 1960. **$50 Million Oil Sands Project Scheduled. Page 183.**

☐ **Discovery of more oil,** establishment of an oil and natural gas commission, rising crude requirements and trade with Russia combine to make India the focal point of considerable petroleum industry interest. For an interview with Shri K. D. Maliviya, India's minister for Natural Resources, see **Page 185. A World Oil Interview: Indian Minister Evaluates Oil**.....**Don Kliewer**

☐ **The first waterborne geophysical survey** to be conducted by The British Petroleum Company off the coast of Great Britain was completed recently. Analyses of the study will be made at BP's London office. See the picture story of this initial BP operation. **British Petroleum Stepping Up Search for Oil. Page 186.**

☐ **Oil seeps, favorable stratigraphic conditions** and possibilities of numerous structures combine to make northeast Bolivia an attractive area for oil exploration. See **Page 188** for an expert evaluation of current data on the region. **Northeastern Bolivia Offers Good Oil Possibilities**.....**Victor Oppenheim**

☐ **Italy, plagued by continuing efforts** aimed at ousting private capital operations, finds blocking of the Suez Canal may affect industrial economy. Turn to **Page 192. Suez Action Is Hard Blow To Italian Oil Industry**.....**Antonio Giordano**

☐ **Panamanian exploration is** being accelerated, resulting from the oil discovery recently made in eastern Costa Rica. Many U. S. oil companies have entered the play, and active geophysical and geological operations soon will be under way. For details see **Page 194. Panama Activity Accelerated By Costa Rican Discovery**.....**Edward A. Koester**

Turn the page for a Quick Look at what's ahead in WORLD OIL ▶

NEXT MONTH . . .

What's New in Exploration Methods

WORLD OIL'S Special Exploration Progress Issue to be published next month is geared to give you a "mountain top" look at latest geophysical tools and practices.

That is important! Because the trend has now become a race among oil-searchers for new and improved exploration methods that will cut costs and improve efficiency.

In this special issue, you will have ready-reference material on significant developments such as: submarine mapping for offshore work . . . the nuclear magnetometer and how it works . . . newly designed direct recording heads . . . "stacking" of records in magnetic recording . . . a device for logging shallow core holes . . . and automatic plotting.

Here is just part of the information of value you'll find in this special issue:

- **How to Detect Subsurface Faults by Radioactive Measurements**
- **How to Use the Gravity Meter as a Torsion Balance**
- **How and When to Use Modernized Core Drilling for Structure**
- **How to Apply Digital Computers to Geophysical Problems.**

Each page of the Special Exploration Issue contains the facts and figures . . . presented in crystal-clear language that will help you do your job better.

For instance, you will know how to:

- **Select equipment designed to solve your operating problems**
- **Revamp old equipment to secure maximum effectiveness**
- **Evaluate recent exploratory techniques**
- **Streamline your activity**
- **Speed up operations.**

The issue was prepared and written by "top shelf" executives and scientists in the fields of geology and geophysics. As a result, you will know the latest thinking on what is being done and why in this very important division of the industry.

So . . . be on the lookout for your copy of the 1957 Exploration Progress Issue.

Specialized oil publications of THE GULF PUBLISHING COMPANY, 3301 Buffalo Drive, Houston 19, Texas; Box 2608, Houston 1, Texas. Cable Address: GULFPUBCO.

WORLD OIL and THE COMPOSITE CATALOG for the drilling-producing industry.

PETROLEUM REFINER and THE REFINERY CATALOG for the refining-natural gasoline-petrochemical industry.

PIPE LINE INDUSTRY and THE PIPE LINE COMPOSITE CATALOG (first edition to be issued in July, 1957) for the oil and gas pipe line industry.

ABC

RAY L. DUDLEY.....President and Publisher
TOM W. NELSON.....Vice President-General Manager
R. M. deSOMBRE.....Vice President-Assistant General Manager
WARREN L. BAKER.....Vice President

EDITORIAL

Warren L. Baker, Editorial Director; W. B. Colvin, Associate Editor, Technical; L. J. Logan, Associate Editor, Economics; Don Kliewer, Associate Editor, International; Wallace Fitzgerald, Managing Editor; John N. Schuelke, Drilling Editor; John J. Robertson, Production Editor; Cecil W. Smith, Statistical Editor; Don E. Lambert, Management and Personnel Editor; Jack Cockerham, Presentation Editor.

District Editors: Gilbert M. Wilson, W. W. Wilson Building, Huntington Park, Calif.; Anthony Gibbon, Enterprise Building, Tulsa 3, Okla.; Harrison T. Brundage, 250 Park Ave., New York 17, N. Y.

Editorial Assistants: Mary Stuart Warren, Fern C. Reed, Margaret McKenzie, Beverly Drawe. Librarian: Eunice M. Okoneski.

ADVERTISING

D. S. Craig, Advertising Sales Manager. *Representatives:* NEW YORK (17): Nelson Bigelow, Gene Hart, George Skelton, 250 Park Ave., Phone YUkon 6-6558; CLEVELAND (15): Bill Westfall, Harvey Dunn, 1010 Euclid Ave., Phone MAin 1-3295; CHICAGO (4): H. G. Fitzpatrick, Martin Halloran, 332 So. Michigan Ave., Phone Wabash 2-9330; LOS ANGELES: Jay Curts, W. W. Wilson Bldg., Huntington Park, Phone Ludlow 7-1219. TULSA (3). Jim Isaacks, 916 Enterprise Bldg., CHerry 2-9211; DALLAS (2): Ed Thompson, Room 518, Second Unit, Santa Fe Building, Phone RIverside 7-7344; HOUSTON (19): Charles Wyatt, William G. Dudley, 3301 Buffalo Drive, Phone JAckson 9-4301; EUROPEAN: Theodor Miocha, Agent, Limmerstrasse 31, Hannover, Germany, Phone 4-2935; UNITED KINGDOM: Frank Chambers, Agent, 120 Moorgate, London, E. C. 2, Phone Monarch 5661. Advertising rates on application.

ABP

SUBSCRIPTIONS

R. M. deSombre, Circulation Manager, P. O. Box 2608, Houston, Texas, U. S. A.

Single copies 50 cents (except special issues). Double prices for single copies more than one year old. Subscription price: domestic and foreign, $2 a year.

WORLD OIL published every month except semi-monthly in February and August. **Copyright, 1957, by The Gulf Publishing Company. WORLD OIL and THE OIL WEEKLY are registered trademarks of The Gulf Publishing Company, Houston, Texas.**

Indexed by Industrial Arts Index and Engineering Index

Looking Ahead . . .

Unsettled Markets Threatened . . . The petroleum industry may have unsettled markets and weakening of prices of products and crude in coming months, unless producing and refining levels are carefully regulated to needs. Demand for all petroleum will be at the lowest levels of the year in late spring and early summer. Along with the seasonal decline in consumption there will be a sharp drop soon in exports when oil begins to move again through Suez Canal.

Readjustments of U. S. crude production and refinery runs will have to be made then to maintain stable and orderly markets. Accumulation of surplus stocks of gasoline and other products will need to be avoided.

•

Public Relations Suffer from Price Increases . . . Besides economic troubles the oil industry has run into unfavorable public relations over price increases. Chances consequently are less for legislation vital to domestic oil industry, such as import quotas and natural gas decontrol.

•

Whole Economy Now Disturbed . . . While having special problems of its own, the petroleum industry also is now subjected to troubles disturbing the general economy. Production is outrunning demand in an increasing number of industries. Those lines include steel, aluminum, copper, paper, chemicals, textiles. Residential construction continues to lag. Automobile sales and production have not come up to expectations. Prices of some commodities have softened, including steel scrap, copper and aluminum. These declines in some prices have occurred in spite of recent increases in prices of oils, some steel goods and rises in some wages and freight rates. Marked by these cross currents, business in general appears to be moving about level on a high plateau but encountering some downward pressures.

•

Narrowing of Profit Margins Expected . . . Profit margins of U. S. business will be whittled further in 1957, despite second quarter gains over a year ago in volume and value of sales. This is the consensus of a majority of the 1535 business executives interviewed by Dun & Bradstreet.

•

Middle East's Loss Canada's Gain . . . Faced with what some persons fear may be long-term troubles in the Middle East, it can be expected that financiers in Great Britain will make a new appraisal of Canada's oil prospects. Therefore, increased exploration and development can be anticipated for Canada's burgeoning oil industry through possible mergers and new money from abroad.

•

In Situ Considered for Oil Shale . . . Several major oil companies are working hard to try to determine the feasibility of producing oil shales in western Colorado, the

The combination of durability, deep penetrating action and fast cutting speeds makes CP

Three Cone Rock Bits the favorite of drilling rig operators everywhere. Available in seven different types, there's a CP bit for every kind of formation from soft to exceedingly hard and abrasive. For more details write Oil Tool Division, Chicago Pneumatic Tool Company, 5000 U.S. Highway 81 So., Fort Worth, Texas.

Chicago Pneumatic

GENERAL OFFICES: 8 East 44th Street, New York 17, N. Y.
IN CANADA: 10103 81st Ave., So. Edmonton, Alberta, Canada
IN MEXICO: D. R. Rosas Moreno No. 41, Mexico City, D. F., Mexico
PETROLEUM MACHINERY CORPORATION: 30 Rockefeller Plaza, New York 20, N. Y.
(Export Agent, exclusive of Mexico and Canada)

THREE CONE BITS • REAMING BITS • REAMERS • DRILL COLLARS • TOOL JOINTS • SUBS • JUNK BASKETS

Athabasca tar sands of Canada, and tar mats of western Venezuela through *in situ* combustion methods. The main question—whether the pay formations have sufficient permeability to air to make such methods workable.

•

Wolf Calls to Engineers . . . Growing need for more engineers is beginning to break down management's traditional notion it can't employ women as engineers. In fact, some top companies are emitting loud wolf call for engineers with feminine gender. E. I. du Pont de Nemours & Company now employs 300 women with technical degrees. Union Carbide and Carbon hired 40 women with technical degrees in '55.

•

Maintenance Engineers' Influence Grows . . . Recent survey shows 66 percent of maintenance engineers had major role in purchase of new equipment, and 79 percent influence decision on what brand to buy. 78 percent of engineers said they are increasing their influence on purchasing—22 percent said influence is same as in the past.

•

New Trends in Electronic Brain . . . Prediction: Market for industrial electronic equipment will double in next five years. A new multibillion dollar business is coming into full bloom—and oil companies will be among its biggest customers. One example of what's in store is "cryotron" (tiny piece of straight wire about 1/10 inch long, wound with single layer of control wire the size of a human hair) which may have far-reaching effects on computers. One prediction is that a large-scale computer might be built that would occupy only one cubic foot of space. Operating power cost would be almost nil.

•

More Permanent Completions Ahead . . . Permanent well completion methods will be used increasingly along the Gulf Coast, especially offshore. In the past six months several major oil companies have conducted extensive surveys to determine future possibilities of permanent completion. The number of Gulf Coast wells being equipped for permanent completion operations has been increasing steadily.

Interest in through tubing operations is whetted by high cost and scarcity of workover rigs. Operators complain it's nearly as cheap to drill a new well as to work one over. As more wells are permanently completed, the big problem of inexperienced personnel is thereby being overcome.

•

Unit Plan Will Boost Oil Recovery . . . Operators hope to have the Rangely field, Colorado's biggest, in operation under the unit plan by June. Unit operation will provide production of 30 to 80 million barrels of oil that might never be produced under present competitive conditions. Flaring of gas produced with oil will cease under unit operation. Gas will be used to repressure the producing formation, thereby increasing oil recovery. Discovered in 1934, Rangely was not developed until the war years. It has produced 200 million barrels of oil. From 175 to 200 million barrels more are expected to be produced under primary methods of recovery. It is believed that water-flooding can provide additional recovery of 200 to 300 million barrels of oil not producible by primary methods.

Some 22,000 acres are involved in the unitization. The California Company (Standard of California subsidiary), largest operator, will serve as unit operator. It and four other companies (Stanolind, Phillips, The Texas Company, and Sharples Oil Company) account for the bulk of Rangely's current production of about 75,000 barrels daily.

Several other major fields in the Rocky Mountain region are operated on unit basis. They include Salt Creek, Elk Basin, Lance Creek, and Lost Soldier in Wyoming and Poplar field in Montana.

Good Wells Make Good News

Which well treatment pays out fastest? There is no single answer to that question. The type of formation, character of the produced fluid, type of completion, market conditions and allowables all enter into the problem. Regardless of the factors contributing to payout time, however, Dowell can tailor a treatment for optimum return. Here are some examples.

- ***Fort Bend County, South Texas*** — (Old well) Thompson Field. Production had declined to one barrel of oil per day. Allowable was 44 barrels. Operator suspected emulsion or water block. Dowell recommended Formation Cleaner treatment using a special Dowell de-emulsifying agent in 1000 gallons of lease oil. Total treatment cost was only $300 and well was restored to its allowable. ***Treatment paid for itself in less than four producing days.***

- ***Hamilton County, Illinois*** — (New well) Completed in Aux Vases sandstone (permeability 70 millidarcys) at 3145-3159 feet. Dowell treated the well with Petrojel*, using 20,000 gallons of fluid (one pound sand per gallon), and a 500-gallon Mud Acid spearhead. Injection rate was 52 barrels per minute at 1100 pounds per square inch. Production after treatment was 80 barrels of oil per hour. After 15 days, well was flowing 300 barrels of oil per day. At two dollars per barrel, ***$3,555.50 treatment would pay out in less than one week!***

- ***Weld County, Colorado*** — (Old well) The Campbell #2, completed in the dirty, shaley, Dakota "J" Sand of the Roggen Pool, had declined in production to 30 barrels of oil per day. Allowable was 40 barrels. Since operator could profit from only 10 barrels daily of any production increase, an inexpensive treatment was indicated. Dowell gave the well an $843 Mud Acid treatment which boosted production to 70 barrels of oil per day. ***In spite of the fact that the net production gain was low, this treatment paid for itself in only six weeks.***

- ***Beckham County, Oklahoma*** — (New well) Production of gas well completed in dense and tight Brown dolomite was a noncommercial 200,000 cubic feet per day. Treated with Riverfrac*, using 30,000 gallons of water with 1 pound of sand per gallon, and a spearhead of 1,000 gallons of Dowell Intensified Acid. Production stabilized at 2,500,000 cubic feet per day. ***At contract prices, $3,700 treatment was paid out in less than 20 days.***

Whatever treatment your well requires, you can get it from Dowell. Good equipment, experienced operators, and the widest selection of fracturing and acidizing techniques enable Dowell to tailor the job to fit your requirements. For more information or service, call any of the 165 Dowell Offices in the United States and Canada; in Venezuela, contact United Oil Well Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma.

*Service Mark of Dowell Incorporated

Services for the oil industry

DOWELL

A Service Subsidiary of The Dow Chemical Company

Higher Oil Prices Justified

Widespread attacks by the public and particularly members of Congress on the U. S. oil industry because of recent price advances are wholly unjustified. Other commodities have advanced more in price without creating such furor. Oil industry costs, like other businesses, have risen in recent years. Gasoline and other oil products are still one of the lowest priced commodities on the American market.

The situation demands that oil men do everything in their power to inform the public and politicians that higher prices were necessary and reasonable. It is not enough that the prices be justified and reasonable, the industry must prove this point. To do this oil men must do more talking than they are customarily inclined to do. Otherwise, public attitude toward oil will sink to a new low.

•

Crude prices have advanced less than most other products. The recent increase was the first since June, 1953, and the second since December, 1947. The national average price for crude oil currently is less than 20 percent higher than in 1948, and but 12 percent above 1953.

Other commodities, with the exception of farm and food products, have risen at much higher rates. Prices of iron and steel are 55.7 percent over 1948 and 23.7 percent over 1953. Still another increase of $6 to $8 per ton for oil country tubular goods was announced in February. Metal and metal alloy products are up 46.3 percent over 1948, and 19.8 percent above 1953. Machinery is up 42.2 percent over 1948, and 16.7 percent since 1953.

•

Oil's costs have risen sharply in recent years. The industry uses large quantities of steel, metal and machinery. It takes an average of 80 tons of steel for each new well drilled. In contrast, the average automobile requires less than two tons of steel, yet motor vehicle prices are up 34.8 percent since 1948 and 14.3 percent above 1953.

Oil industry wages, like those in other businesses, have advanced sharply. Average hourly earnings in the oil industry are 53 percent above 1948 and 15.4 percent over 1953.

To satisfy increased oil demand, the industry has greatly accelerated its expenditures for drilling operations. Nearly 60,000 wells will be drilled in the U. S. during 1957, compared with only 49,480 in 1953 and 39,477 in 1948. Footage drilled has risen even more rapidly. Approximately 240 million feet will be drilled in 1957, whereas only 136¾ million feet were drilled in 1948.

To find enough oil to satisfy higher demand, the industry has nearly doubled its wildcat drilling operations since 1948. Only 6410 wildcats were drilled in 1948, but the forecast for 1957 is 12,911. Wildcats, the most expensive type of well, constituted 22 percent of all wells drilled in 1956, in contrast with only 17.1 percent in 1948. Eighty-eight percent of all wildcats drilled invariably fail to find production.

Increased wildcatting has resulted in dry holes making up a much larger portion of the wells completed annually. In 1956 dry holes totaled 22,111, or 38.7 percent of all wells drilled for production. Half as many dry holes (11,939) were drilled in 1948.

Every producing well completed last year will have to pay for two-thirds of the cost of a dry hole in addition to its own drilling and operating costs. In 1948 each new producing well completed had to produce enough to pay for less than one-half the cost of a dry hole in addition to its own drilling and operating expense.

Between 1946 and 1955 inclusive capital expenditures of the oil industry in the U. S. has amounted to $38 billion. No other industry has matched this rate of investment.

•

Oil product prices are still low in comparison with other commodities. They remain one of the least expensive of all commodities.

The average U. S. service station retail price of motor fuel after the recent advance is 31⅕ cents per gallon. However, taxes make up nearly 9 cents of this total. Even with taxes included this is cheap, costing but 2 cents per mile traveled.

In comparison price of other commodities are much higher. Milk costs from 84 to 96 cents per gallon. Popular soft drinks cost 80 cents a gallon when sold at 5 cents per 8 ounce bottle. Restaurant coffee at 5 cents per cup totals 80 cents per gallon. Gasoline weighs approximately 6 pounds per gallon, hence sells for just over 5 cents per pound including taxes. What else can be bought these days for 5 cents per pound?

The public pays 2½ cents more per gallon for gasoline today than in 1953. However, since 1953 taxes on gasoline have risen 1⅓ cents per gallon (18.6 percent) while the price itself has advanced but 1⅛ cents per gallon (5.3 percent). The price of practically everything else has gone up at least this much, why shouldn't gasoline?

Warren L. Baker

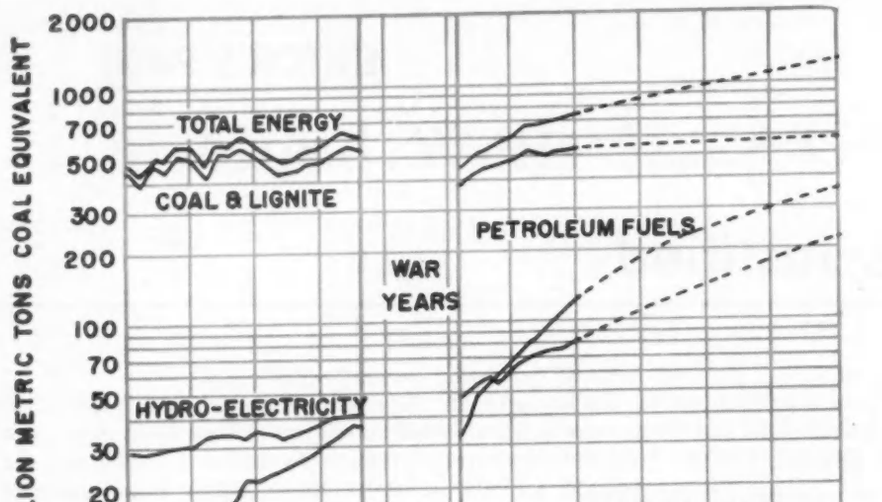


FIGURE 1—Pattern of West European energy consumption forecasts exceptionally sharp increase in use of petroleum.

West Europe Oil Demand to Be Strong in Next 20 Years

- Petroleum consumption is expected to increase 5½% annually between 1955 and 1975.
- Oil use will be enlarged by growth of manufacturing and substitution of oil for coal.
- Hydro-electric power use to rise. Nuclear power may supply 6% of energy needs by 1975.

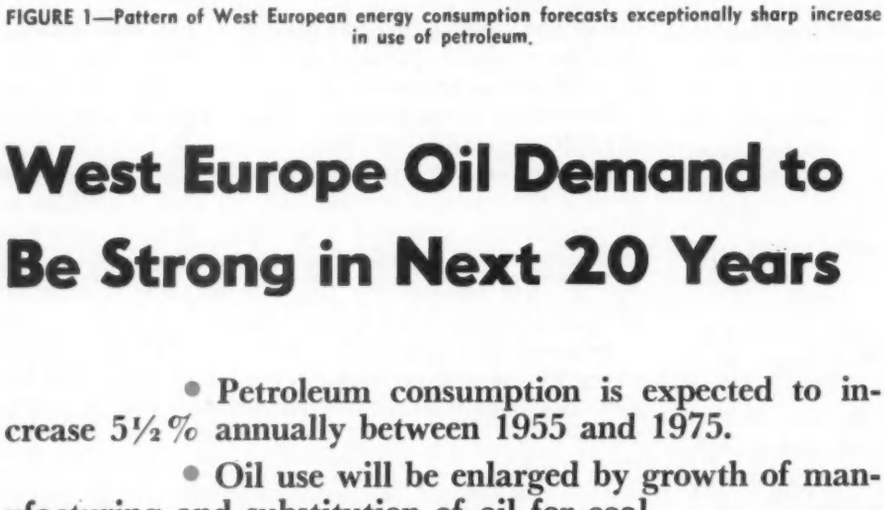


FIGURE 2—Future growth of total energy demand in selected Western European countries.

By G. P. GLASS and J. H. D. PAGE
Shell Petroleum Company, Ltd.
London, England

PETROLEUM CONSUMPTION can be expected to increase about 5½ percent annually over the next 20 years in the Western European region covered by the Organization for European Economic Cooperation.

The long term economic outlook for the region is good. Prospects for the major countries alone suggest a substantial rate of economic growth for the area as a whole. Manufacturing production should more than double between 1955 and 1975. Total demand for energy consequently will increase steadily. The demand for energy derived from petroleum will be particularly strong and buoyant.

These conclusions are based upon an analysis of growth rates for individual sources of commercial energy in the main geographical areas.

Total energy consumption in the Western European area will increase by an average of about 2.6 percent annually over the next 20 years, the studies indicate.

As illustrated in Figure 1, this implies an increase in total energy consumption from some 750 million tons coal equivalent in 1955 to a level of 1250 million tons coal equivalent in 1975.

While hydro-electricity production will continue to increase, it is anticipated that the coal industry's share of total energy consumption will decline in the future. If it is assumed that by 1975 at least 6 percent of total energy requirements will be met from commercial supplies of nuclear power, then the demand for petroleum fuels and natural gas can be expected to grow at an annual average rate of the order of 5½ percent over the 20-year period.

The outlook for energy demand in selected Western European countries is illustrated in Figure 2.

The individual country assessments on the chart are based in the first instance upon observed associations between past increases in manufacturing production and increases in energy consumption. These associa-

tions have been applied to anticipated future trends.

United Kingdom. In the United Kingdom it is not expected that the high post-war rate of advance can be maintained. The considerable scope which exists for increasing productivity must be fully exploited if the United Kingdom is to consolidate and expand its position in difficult international markets.

Over the past 25 years manufacturing production has risen on an average of about 2½ percent per annum. But in view of the great changes which have occurred in the United Kingdom's economy since the second World War, it is thought that the future long-term rate of increase in manufacturing production will be at least 3 percent and that the rate over the next few years ahead may be as high as 4½ percent.

Over the period 1921-1954, the association between manufacturing production and energy consumption in the United Kingdom has remained stable where increases in manufacturing production of x percent have been associated with increases in energy consumption of 0.5x percent. If it is reasonable to expect a growth in manufacturing production of 4½ percent per annum, scaling down to 3 percent in a long-term, future energy demand may be expected to grow at 2.2 percent per annum over the next 20 years; probably with a higher rate in the early years. This implies a total increase of 55 percent in energy requirements by 1975, or in terms of coal equivalent, a United Kingdom energy consumption by 1975 of 390 million tons, compared with 252 million tons in 1955.

Western Germany. The substantial economic advance attained by Western Germany in recent years is expected to receive some check from labor shortages which will probably be reflected in increases in the price of this production factor. There are also signs that Western Germany's comparative advantage on delivery dates in the engineering and ship-building industries is declining.

In spite of this evidence of high pressure on resources, it is clear that Western Germany's monetary and trade policy has so far succeeded in maintaining a relatively stable price level and a sound balance of payments position.

The very high rates of increase in manufacturing production of almost 12 percent per annum since 1950 in Western Germany can scarcely be expected to continue in the long term. A rate of 7 percent, scaling down to 4½ percent over the 20 year period, is therefore felt to be a reasonable estimate.

Although the lack of comparable pre-war data renders these rates highly speculative, on the basis of a 4.5 percent annual increase in manufacturing production, energy consumption in 1975 would be 70 percent above the 1955 level.

France (Excluding Saar). Manufacturing production in France has increased at a rate of 2.5 percent per annum over the period 1932-1955. Since 1948, the annual increase has been just above 5 percent and associated with this there has been an increase in energy demand of a little over 3 percent per annum. Over the next few years manufacturing production may well continue to rise at about 5 percent per annum. But in the longer term, it is felt that an annual increase of more than 3 to 3½ percent is unlikely. In these circumstances, an annual increase in energy demand of about 2 percent is likely to prevail over the 20-year period.

It is appreciated that this estimate may appear to be somewhat conservative when compared with the rather higher long-term energy growth rates of 3 to 4 percent per annum predicted by M. Lemaire and M. Coude du Foresto. In their view, total energy consumption in France may be of the order of 200 million tons coal equivalent by 1975. The outcome for energy demand 20 years from now may be somewhere between 155 million tons coal equivalent and the above "target" of 200 million tons currently referred to in French political circles.

Italy. Industrial production in Italy since 1921 has increased by approximately 4 percent per annum on average and since 1950 by over 8 percent per annum.

The Vanoni Plan, a 10-year development scheme which was announced in January, 1955, aims at the investment of approximately $40 billion in industrial and agricultural developments in the southern half of the peninsula. Although it is not yet certain whether external financing will be forthcoming, it is considered that help of this kind will be indispensable. Even so, it seems reasonable to assume that manufacturing production may in the long-term increase at an annual average rate of about 5½ percent.

Unfortunately, the historical association between manufacturing production and energy consumption has not proved to be very stable. But experience over the period 1929-1954 suggests that energy consumption in Italy may grow at about 4.7 percent per annum over the period.

Sweden. National income in real terms in Sweden has risen by about 3½ percent per annum since 1929, and by approximately 4 percent per annum since 1946. A 3½ percent annual rate seems a reasonable rate for the future. On this basis the long-term energy growth rate may be as high as 3.7 percent per annum.

Balance of Western European Area. While the balance of the Western European area will influence the over-all energy picture, the individual countries are not expected to affect it to any great extent. For this reason, no separate assessment is offered apart from the view that over the period 1955-1975, aggregate demand for total energy in these countries may increase by 2.6 percent per annum, from 145 million tons to about 235 million tons coal equivalent in 1975.

About the Authors

G. P. GLASS and J. H. D. PAGE of the Economic Division of the Shell Petroleum Company, Ltd., London, have been studying for some years the various economic factors which will affect the future growth of energy demand and, inter alia, the demand for oil.

Glass is a graduate of the University of Glasgow and is now manager of the Economic Division. Page is a graduate of Oxford University.

ACKNOWLEDGMENT

Courtesy Institute of Petroleum, London, England.

U. S. Not Running Out of Oil

• Current levels of operations will assure continued development of new oil at an increasing rate.

• Improved producing techniques and additional discoveries will make recent estimates of ultimate production conservative.

• Country will have sufficient domestic oil if industry is not damaged by unreasonable taxes and excessive imports.

By RICHARD J. GONZALEZ
Director and Treasurer
Humble Oil & Refining Company
Houston

CONTRARY TO SOME recent predictions, the U. S. need not worry about running out of oil in the near future. There is no need to slow down use of domestic resources and use more foreign oil to postpone the evil day of great dependence on foreign oil or more expensive alternate fuels.

The rate at which new oil is being developed in the U. S. has increased steadily to date and the current levels of operations mean an increase in the rate of discovery for the foreseeable future. Recent estimates of ultimate recovery will prove conservative because of improved producing techniques and additional discoveries in new and old provinces. As more oil is discovered and made producible by improved methods, the estimate of ultimate production in the U. S. will continue to be pushed upward and the predicted date of running out of oil will be pushed farther into the future.

The amount of oil to be found and produced in the U. S. will be affected by national policies on (1) imports and (2) taxation of domestic production. A reasonable volume of imports will serve as an effective stimulus to efficiency in domestic operations, but an undue volume of imports will have a damaging effect on progress and security. Reasonable tax provisions are essential to encourage development of domestic resources in order that the U. S. may have sufficient petroleum for its future progress.

Cumulative discoveries of crude oil in the U. S. through 1955 exceeded 82 billion barrels. According to records of production and official estimates of reserves made at the time, the new oil discovered was 13.2 billion barrels in the 66 year period 1859-1925, and then for the next three decades 17.4 billion barrels, 20.8 billion barrels, and 30.9 billion barrels, respectively (Figure 1). Nothing in this record suggests any slowing down in the rate of discovery. In terms of results per well drilled, only a slight downward trend is evident over the past 30 years, and this trend may be checked or reversed for the next 10 years by the high results per well expected from offshore drilling (Figure 2).

For the past 20 years the development of new oil has kept pace with the completion of oil wells (Figure 3). In 1956, about 59,000 total wells and 32,000 oil wells will be completed in the U. S. On the basis of experience in the period 1936-1955, this rate of drilling maintained over a decade should develop more than 40 billion barrels of new oil. Since drilling responds to the volume and value of production (Figure 4), it will be surprising indeed if drilling and development of new oil over the ten years 1956-1965 does not exceed the rate in 1955. The minimum expectancy for new oil over the next decade represents a continuation of the past upward trend of discovery in proportion to the rate of exploration and drilling.

There is no way for anyone to know how much oil will be found in the U. S. The answer will depend on economic variables and national policy as well as on the unknown quantity of oil existing beneath the surface of the earth. The U. S. Geological Survey concluded in 1951 that the time has not yet arrived when a definite accurate estimate of ultimate production can be made. Its views on the

New Crude Oil* Increases in Proportion With Production

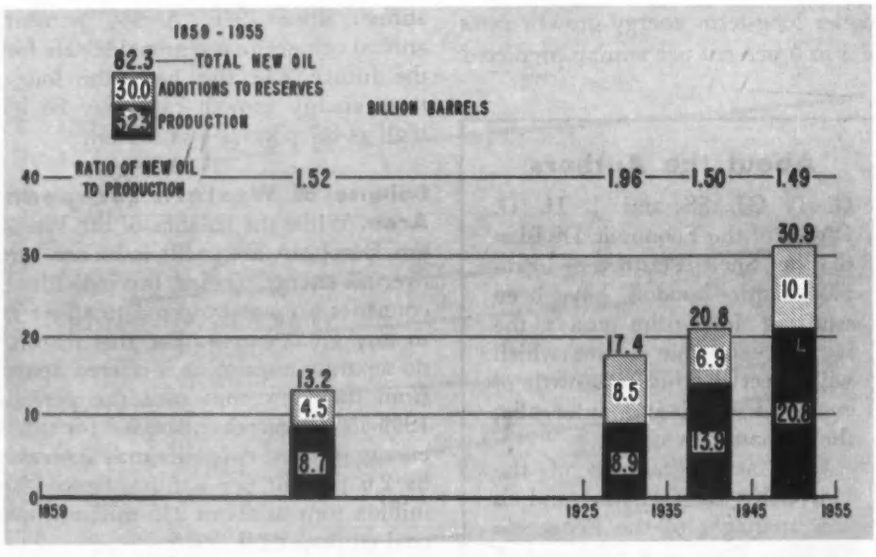


FIGURE 1
(*Discoveries, extensions, and revisions based on reserve estimates of Federal Oil Conservation Board for 1926 and crude oil included in A.P.I. reports.)

prospects for future domestic supplies were expressed as follows:

"If the future can be judged by the past, oil and gas will be found in sufficient quantities for many years to come. In the U. S. adequate production has been a direct function of economic incentive. Until the unpredictable date at which that incentive fails to provide the needed supplies, there will be no convincing evidence that we have reached the limits of our ability to expand the potential ultimately recoverable reserves of petroleum."[1]

Recently, some estimates that the U. S. will produce ultimately only 150-200 billion barrels of oil have attracted widespread attention because they indicate that the U. S. will reach its maximum production in 10 or 20 years and be running out of oil before long. Much less attention has been given to an estimate by the Department of Interior which is 50-100 percent higher:

"Considering that trends in production and discovery are still headed upward, and that significant improvements in recoverability are now being accomplished or promised in the future, a total of 300 billion barrels as the ultimate reserves of the U. S. and of the adjoining Continental Shelves seem to be a reasonable figure."[2]

Predictions of ultimate discovery are apt to prove conservative for several reasons. Many of these predictions appear to be based on the idea that there remains to be discovered only as much oil as has been found in the past. Under such assumption, it will always be true that the predicted production curve will show a decline in output within a foreseeable period of time. Based on past experience, there is serious question of the validity of such assumption. In 1941, the most optimistic estimate of ultimate production was 100 billion barrels, or slightly more than twice the estimate of the recoverable reserves that had been discovered up to that time. The estimate of cumulative discoveries had already passed 82 billion barrels by 1955 with the likelihood that the figure of 100 billion barrels may be exceeded by 1960. In less than 20 years there will have been discovered all the remaining oil expected by the most optimistic estimate of 1941. With the undisputed evidence of larger discoveries, the latest estimates of ultimate production have already been raised

Development of New Oil Per Well Remains Constant

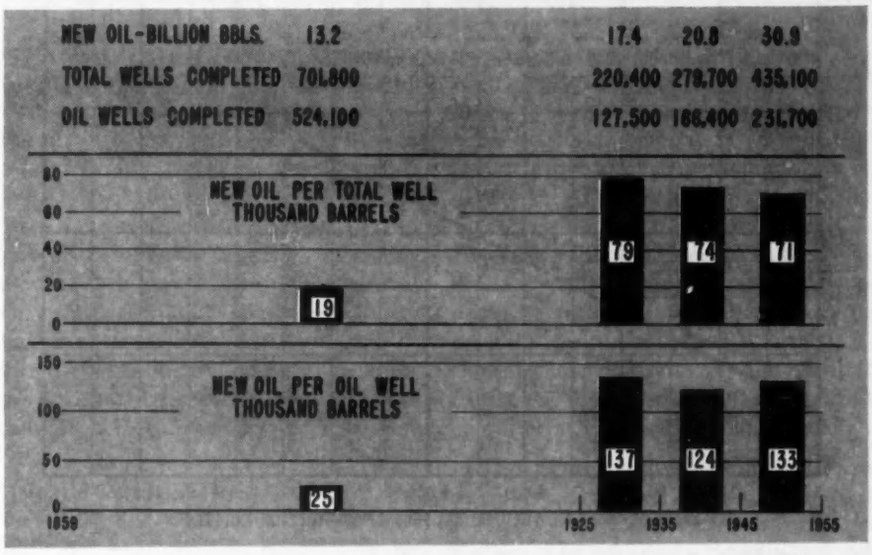


FIGURE 2

substantially. In another 15 or 20 years, as discovery continues to confound the predictions that we are running out of oil, estimates of ultimate domestic production may well exceed even the most optimistic recent estimate of 300 billion barrels.

Even scientific estimates of ultimate oil production based on the application of a factor for reserves to be discovered per square mile of sedimentary area and a factor as to the proportion of the discovered oil that will be recovered by production have proved conservative in the past because both of these factors change upward with time as a result of additional discoveries and improved techniques.

The discovery of more oil provides a basis for more confidence as to what may be produced from the total sedimentary area, only part of which has been explored and developed. It is interesting to note that one of the most intensively drilled areas in the world, the North Texas area of 33,470 square miles, is still the scene of active drilling and increasing production although more than 4 wells per square mile have been drilled in the area. The active search for oil in recent years leaves no question that the industry expects to find substantial ad-

Cumulative New Crude Oil* Keeps Pace With Completions

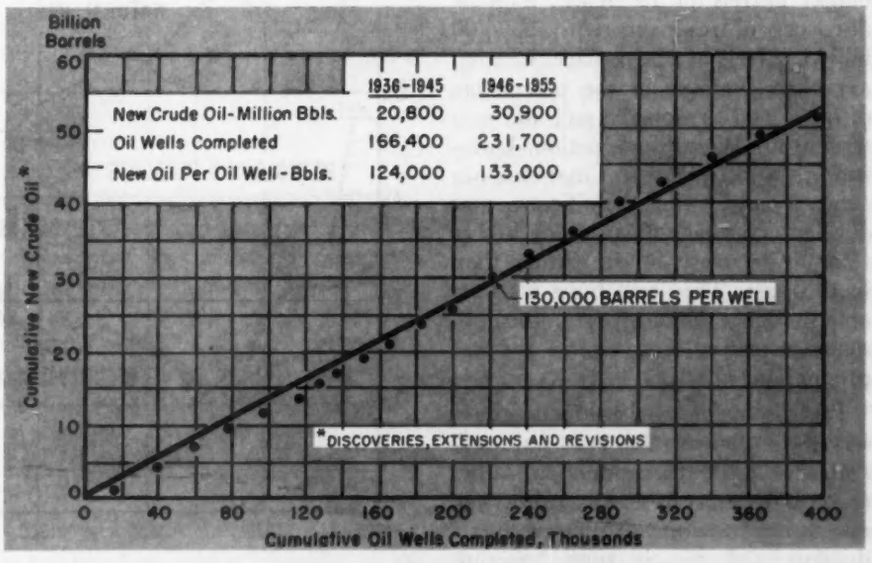


FIGURE 3

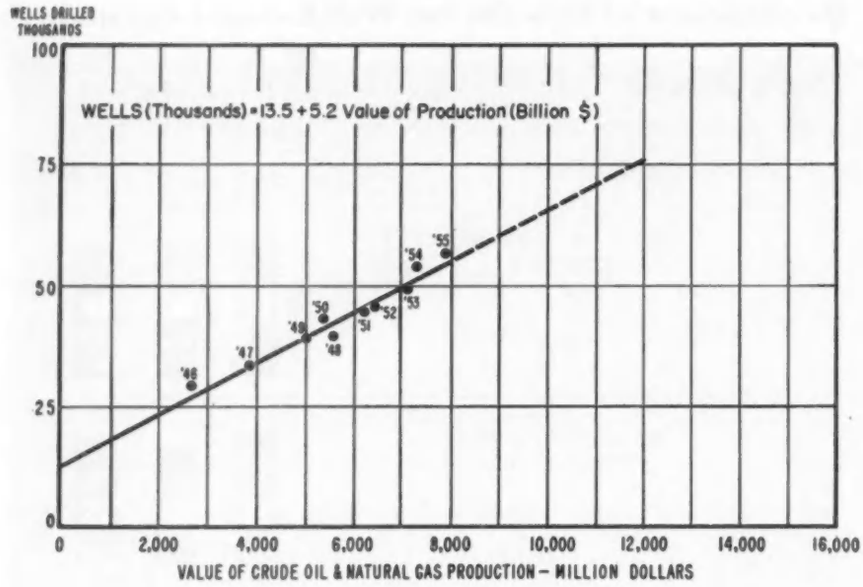


FIGURE 4—Drilling depends on the value of oil and gas production in the U. S.

ditional quantities of oil in both old and new producing provinces. As more oil is found in old and new provinces (such as the Continental Shelf, the Williston Basin, and the Four Corners of Arizona, Colorado, New Mexico, and Utah), more information will become available as a guide to the effective search for still more deposits.

Changing technology is another factor that makes it difficult to predict now what ultimate production will be. Scientific estimates of ultimate production appear to be based on recovering only about 40 percent of the oil in place, reflecting past experience and current practices. Estimates that ultimate production will be 200-300 billion barrels of oil really indicate discovery of reservoirs with 500-700 billion barrels of oil in place. Clearly, a modest increase in the percentage of oil in place recovered will add materially to ultimate production. Unitization and pressure maintenance projects and other significant new developments may mean much higher rates of recovery in the future than in the past. They will have a favorable influence in future years on estimates of proved reserves and ultimate production.

Past discoveries and production have served to increase reserves and estimates of ultimate production rather than to exhaust reserves. Additional discoveries have meant increased production, and this, in turn, has provided the incentive and financial resources for a greater search for oil. New oil from discoveries, extensions, and revisions has rather consistently been equal to about 1.5 times production. This relation means that over a period of years proved reserves increase by about half a barrel for every barrel produced, paradoxical as that may seem. While the discovery of oil may theoretically limit the possibility of future discoveries from deposits of unknown size, in actual practice it provides information that enables the industry to find oil that might not otherwise be discovered. Until such time as there is clear evidence that the domestic industry cannot find more than a barrel of new oil for every barrel produced, there is no reason to believe predictions that the U. S. will soon be running out of oil. As more oil is discovered, the estimate of ultimate production in the U. S. will continue to be pushed upward and the predicted date of running out of oil will be pushed farther into the future.

Effect of Imports on Domestic Supplies. The preceding discussion has shown that domestic supplies can continue to be developed at a rate in keeping with demand so that the U. S. can limit or reduce dependence on foreign oil. Will this be possible, however, only at greatly increased prices for oil? Shouldn't the U. S. use more cheap foreign oil while it is available and save its own oil for a later day? Doesn't the fact that the U. S. is using its reserves up faster than the rest of the world mean that it should import more oil and decrease the rate of production from domestic reserves? These and similar questions call for consideration of the effect of imports on domestic supplies in deciding what policy on crude oil imports

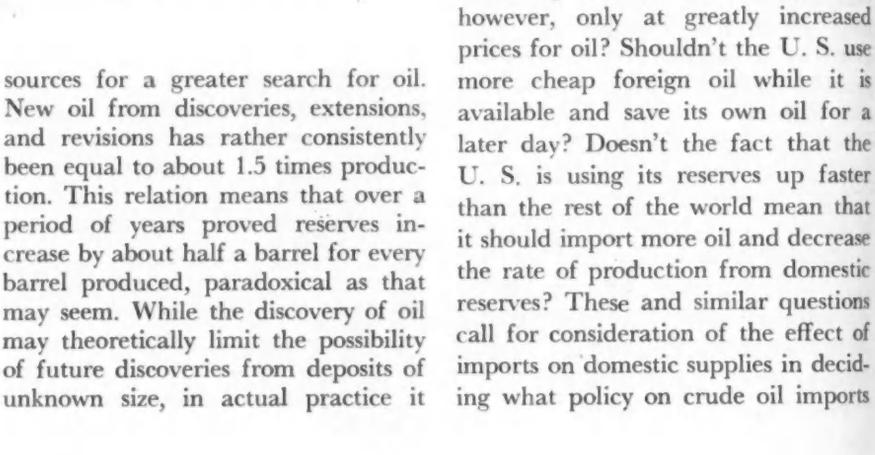


FIGURE 5—Wholesale prices for petroleum and products have been in line with prices for all commodities.

will best serve the national interest rather than the economic interest of the importing companies or the domestic producers.

So much has been said about the rising cost of domestic crude oil and the low cost of foreign oil that a distorted picture is apt to be created as to the relative cost of meeting domestic requirements from these alternative sources. The tendency toward rising real costs for domestic oil is undeniable because of deeper drilling, smaller fields, and a higher proportion of dry holes, but this is only part of the story. Steady progress in exploration methods, drilling techniques, production practices, and the recovery of oil from reservoirs, plus progress in refining, transportation, and marketing are offsetting factors. The great East Texas field with 40,000 barrels of oil per acre was drilled unnecessarily on such close spacing that the average well will recover only 200,000 barrels. With progress in wider spacing of wells, it is not unusual to recover more oil per well even from fields with much smaller reserves per acre. Over the past 30 years, the domestic oil industry has done a remarkable job of keeping the price of crude oil and its products in line with the wholesale price index for all commodities (Figure 5). Continued progress in well spacing and producing techniques can be counted upon to help meet increasing demands at reasonable prices in the future. Petroleum prices have recently lagged behind the price index for wholesale commodities other than farm products. At times in the future they may lag or lead the composite wholesale price index, but it will not be surprising to find that in the long run they will follow a similar trend.

Foreign oil, as sometimes noted by its producers, is not so cheap as some people think. In the first place, there are many expenses not encountered in domestic operations. Next, there is a substantial transportation cost for moving foreign oil to the U. S. Finally, costs may be influenced by changing terms and the life of the concessions. Consequently, foreign oil delivered to the U. S. generally commands about the same price as comparable domestic production, although some of it is sold at discounts of 10-15 percent from normal prices by operators anxious to realize higher profits from additional production of large reserves at low incremental cost.

If the U. S. could count with confidence on an uninterrupted supply of foreign oil at all times, it would seem to be the cheapest immediate course to use any amount of imported oil that could undersell domestic production even if that reduced domestic exploration and drilling. History shows only too clearly, however, that such an assumption is not warranted. For reasons of national security, the Presidential Advisory Committee on Energy Supplies and Resources Policy has recommended that imports of crude oil should increase only in proportion with domestic crude oil production. Such a policy is necessary because of the importance of oil to U. S. security and the hazards involved in greater dependence on foreign oil. Even in the absence of an emergency, foreign oil will not remain cheap relative to domestic production if the U. S. becomes more dependent on imports.

The suggestion that the U. S. use foreign oil when it is available and cheap and conserve its oil for a future date overlooks the impact of imports on domestic exploration and drilling. Because of the relation between production and development of new oil noted previously, the displacement of a barrel of domestic production with a barrel of foreign crude oil will leave the U. S. worse off rather than in a better position on proved reserves. The only possible advantage, which is of questionable value until there are signs that the U. S. is not able to increase its discovery rate, is that there would be more undiscovered oil that might be located in the future. Undiscovered oil is of no use, however, either now or in an emergency. The U. S. cannot wait until an emergency develops to intensify the search for oil because the process of exploration and development takes three to five years or more. The only effective way to provide the resources needed in the U. S. is to expand domestic exploration and development in keeping with the growth in demand. The process of striving to supply greater needs will not only discover more oil but also develop technology for providing fuels from alternate domestic sources, such as shale oil, thereby extending indefinitely our future domestic supplies of energy.

Domestic producers cannot afford to continue an active program of investment in the search for new oil if their returns on large existing investments are unduly low as a result of production being shut back by the increased use of foreign oil. The domestic industry can only be expected to carry a spare producing capacity equal to 15-20 percent of its total capacity, since that is sufficient to take care even of unusual increases in demand, such as occurred in 1950-1951. It cannot be expected to carry increasing idle capacity on which a negative return is realized merely to provide protection against interruption in the delivery of foreign oil that displaces the production from that capacity in the domestic market.

The relative rate at which reserves are being produced in the U. S. and foreign countries has no relevance on the question of whether additional oil should be imported. It only indicates that the U. S. has developed its use of oil per capita to a much greater extent than the rest of the world. On a per capita basis in 1953, the U. S. had about 178 barrels of crude oil proved reserves and used 17.4 barrels annually. At that time, the rest of the free world had about 57 barrels of proved reserves per capita and used 1.1 barrels annually per capita. Even with the substantial increase in estimate of proved foreign reserves since 1953, the reserves per capita in the rest of the free world are lower than in the U. S. The use of oil in foreign countries is increasing much more rapidly than in the U. S. As that trend continues, it is only a question of time until what now seem large foreign reserves will appear moderate in relation to greatly increased foreign requirements.

The availability of domestic supplies will depend not only upon the ability of the domestic industry to keep its costs within reason relative to domestic prices generally but also on national policy with respect to imports. For reasons of national security, it seems reasonable and desirable to assume that the U. S. will choose to keep the relative dependence on total crude oil imports to a ratio lower than has prevailed in 1956, and probably not far from that which prevailed in 1954, unless and until it has no other choice than to become more dependent on imports. A reasonable volume of imports will serve as an effective stimulus to efficiency in domestic production, but an undue volume of imports will be against national interest

because of its damaging effect on an industry essential to the nation's progress and security.

Importance of Reasonable Tax Provisions to Future Supplies. Reasonable tax provisions on petroleum production are also essential in order that the domestic industry may supply increasing quantities of oil to meet requirements in the future. These provisions include the option to expense intangible drilling costs and continuance of percentage depletion at the long-existing rates that are geared to the economics of the petroleum development process.

The intangible expenditures involved in drilling producing wells may be deducted as an expense in the year they are made. If they are capitalized, the tax regulations provide that intangible drilling costs should be recovered as depletion. These expenditures represent an intermediate type between the cost of discovering oil and the tangible investments in equipping a producing lease. The tangible investments which may have a salvage value are capitalized and depreciated in the same manner as tangible investments of other types. The difference in tax treatment for the intangible drilling cost is attributable to the fact that there can be no salvage value to the hole drilled if the lease is not commercially productive. The uncertain life of wells, even under modern conditions, means that if intangibles are not allowed promptly at a time when there is taxable income, they may not be recoverable later because of an absence of such taxable income. This unnecessary risk is eliminated by treating intangible drilling costs as current expense. The effect of this tax provision is principally to shift the time of tax deductions from what should be allowed if intangible drilling costs were treated as capital to be recovered through depreciation.

A large percentage of the wells drilled annually are required merely to develop new oil equal to current production. The cost of drilling such wells has many similarities with maintenance expenditures that manufacturers are allowed to deduct as an expense of conducting operations. If the established system of permitting current deductions of intangible drilling costs were changed to a system of depreciation, petroleum developers would be handicapped in the early stages of drilling a new discovery. Smaller operators in particular might have difficulty in financing development of substantial discoveries. It is desirable to encourage all operators in the development of their discoveries, and this objective is well served by the present option to expense intangible drilling costs.

The principal area of misunderstanding about taxation of income from petroleum production relates not to the expense of drilling costs, however, but to percentage depletion. While the public cannot be expected to understand this complex tax question, some highly vocal critics are trying to make people think that percentage depletion for petroleum is wrong because it exceeds cost depletion on productive leases alone, and that it is too high even if the nature of the business requires recognition of more than cost depletion. The facts involved show (1) that it would be wrong not to recognize that the capital actually depleted by production exceeds accounting costs, and (2) that the rate of depletion is probably too low under existing circumstances.

The unusual risks in the search for oil are clearly quite different from those in most other investment processes. While most capital expenditures result in facilities with a value about equal to cost, money spent in petroleum exploration and development results in capital values that have relatively little relation to the accounting cost for particular producing properties. In these circumstances, accounting costs are not a satisfactory measure of the true depletion of capital incurred in production. As an indication of how far short costs fall of measuring the true capital cost of oil, the following points may be noted:

- Out of millions of acres leased in the search for oil annually, only 5 to 10 percent prove productive.
- Out of 250,000 wells drilled in the past five years, nearly 38 percent have been dry holes, so that the production from the average well has to carry the cost of two-thirds of a dry hole in addition to its own costs.
- Out of about $4 billion or more spent annually on exploration and drilling wells, roughly half of the money is lost on unsuccessful ventures.

The preceding circumstances mean that the true cost of the oil discovered by producing wells is far more than the amount paid to secure leases on the producing properties only. These peculiarities of the petroleum development process led Congress, early in the application of income taxes, to adopt the tax provisions designed to recognize that the business of producing oil differs from other businesses. This decision stems from a basic principle of our tax system that fair treatment requires adequate consideration of different circumstances. The general applications of this theory is evident in the countless differentiations provided in an effort to achieve equitable taxation. Number of dependents, marital status, age, and income level are among the circumstances taken into account for individuals. In business, different tax treatment is provided for certain defense facilities, timber, insurance companies, Western Hemisphere trade corporations, and many other types of activity. Depletion is only one of many provisions of the tax laws adopted by Congress to provide differential treatment in recognition of special circumstances applicable to certain classes of taxpayers similarly situated. This differtial treatment does not constitute a preferential tax advantage.

The economic necessity for percentage depletion greater than cost is generally accepted, but questions are raised periodically as to the reasonableness of the rate. Is a maximum depletion rate of 27.5 percent of gross income, but not more than 50 percent of net income, more in keeping with the economics of the business than a rate of 15 percent, for example? The answer is that the existing rate of depletion comes close to measuring the capital value of oil in the ground while a lower rate would fall far short of recognizing the capital value that should be protected from taxation as ordinary income.

The dictionary defines depletion as an impairment of capital. In order to determine the depletion that should be recognized as a proper deduction in determining taxable income, it is necessary to ascertain the capital value of oil separately from the intangible drilling costs otherwise deductible and from the tangible equipment costs recoverable through depreciation. From actual sales, the current price of developed oil reserves appears to be about $1.25 a barrel, and sometimes even more in sales involving reserved oil payments. Deducting $0.40

or $0.50 at most for drilling and equipment costs per barrel of reserves, the indicated value of oil in the ground to be recognized by depletion is about $0.75-$0.85 a barrel. The maximum percentage depletion deductible on the present average price of crude oil of $2.80 a barrel is $0.77. Effective depletion over the life of a producing property is a good deal less than 27.5 percent of gross income because of the limitation to 50 percent of net income before depletion. Therefore, the present rate of depletion represents less than the capital value that is being depleted by production. In these circumstances, the present rate of depletion cannot be considered too high. Furthermore, if the rate of depletion were reduced, more capital sales of oil would be encouraged and fewer operators would feel warranted in continuing the search for oil.

The economic case for the long-established tax provisions applicable to petroleum exploration and development is sound and should be presented vigorously by the industry. If this case is adequately understood, we should be able to count on continuance of the reasonable tax provisions that have been and will continue to be essential in providing adequate domestic supplies of petroleum.

Conclusion. The leadership of American enterprise in the development of oil resources has been of immeasurable value to the U. S. standard of living and security. The U. S. is fortunate indeed in having ample domestic supplies of oil currently available to protect itself against contingencies and in the prospects of sufficient supplies for the foreseeable future to keep from becoming increasingly dependent on foreign oil. This favorable position should not be jeopardized by unwise action on the national policies concerning imports and taxation of petroleum products which will have such an important bearing on the actual course of domestic exploration and development.

America's freedom and way of life depend on the degree to which it can assure increasing supplies of domestic energy at reasonable cost. For at least our lifetime, oil and gas will be the most important and useful forms of energy. All Americans have good reason to be concerned, therefore, that national policy shall be designed to encourage development of domestic petroleum resources in order that they may have sufficient energy for economic progress and national security. In a period when the U. S. is spending $40 billion annually on defense, it would be foolish to jeopardize the domestic supply of the energy most vital to that defense by unwise policies. There are many good reasons why national policies designed to encourage the development of domestic oil and gas resources should be maintained, but the most important reason is that these policies are essential to provide petroleum for future progress.

REFERENCES

[1] U. S. Geological Survey, "Fuel Resources of the United States," 1951, Page 35.

[2] "Peaceful Uses of Atomic Energy," Vol. 2, Page 82, (Report of the Panel on the Impact of Peaceful Uses of Atomic Energy—Background Material).

ACKNOWLEDGMENT

Excerpt from a paper presented before the Petroleum Branch at the annual meeting of the American Institute of Mining, Metallurgical, and Petroleum Engineers in New Orleans, Louisiana, February 26, 1957. Title of the paper as presented was, "Petroleum For Our Future Progress."

If Oil Could Speak

If oil could speak it would have many fascinating truths to tell the non-oil public—truths that would win thousands of new friends for the oil industry.

But, oil can't speak—you can. You, as an individual, can win many new friends for the oil industry if you will pass the true facts on to your non-oil industry friends.

Here are some of those true facts. They are being presented for one purpose: To keep you posted on your industry, so you can tell the story oil is unable to relate.

Read these facts. You will find them informative—and interesting.

"If Oil Could Speak" it would tell the American public:

- In 1956, the oil industry invested $3.6 billion in exploration and production—an all time high. The increased cost is reflected in the fact that in 1938 the industry developed 34 barrels of oil for every foot of hole drilled—in 1945, 20 barrels per foot were developed—and in 1955, less than 13 barrels per foot were developed.

—•—

- In the U. S. we consume 815 gallons of oil products per person per year. The Soviets appear to consume about 100 gallons per person per year. They have little motor transport. Most of their oil goes for industry and defense. China, with a population of 580 million, seems to get by on a petroleum consumption of one gallon per person per year.

  That the U. S. public has such a tremendous advantage over people in other parts of the world can be attributed to one thing—an oil industry allowed to compete in an atmosphere of free enterprise.

—•—

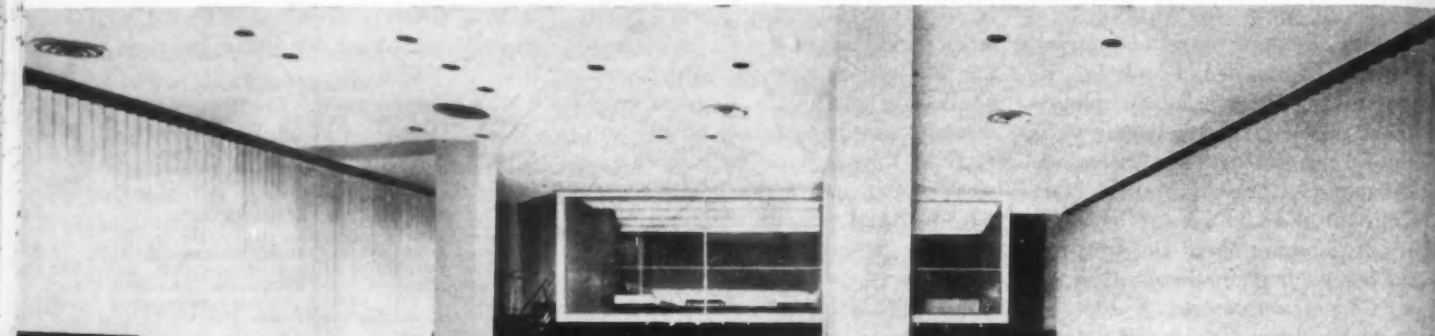
- That tax provisions have accomplished well their purpose of stimulating the search for oil is clearly illustrated in the growth of U. S. reserves. In 1925 crude reserves totaled only 7.5 billion barrels—in 1955 reserves totaled 29.6 billion barrels. And this was accomplished despite a phenomenal growth in demand.

—•—

- No one knows for sure the ultimate discovery potential in the U. S. However, one estimate in 1948 fixed the amount yet to be discovered at 54 billion barrels. If that were correct, the discoverable amount is now down to less than 40 billion barrels, due to discoveries since 1948.

—•—

Remember: Oil can't speak—you can. Only you can give the non-oil public the true facts about your oil industry.



Computing centers such as this will soon be a common fixture in oil industry operations. Some companies are now using similar equipment to solve highly complicated production problems.

Computers Solve Production Problems

Producers are asking three major questions about computers:

What are the purchase and rental costs?
How can computers aid production?
How does a company set up a computing program?

Here are the answers . . .

By DAVID RUBINFIEN and RALPH F. LEWIS
Arthur Young and Company
New York City

PRODUCTION OPERATIONS in the oil industry are probably the most extreme example of the size, dispersion and organizational decentralization which characterize the industry as a whole.

From the viewpoint of electronic data processing, the data sources of production organizations are scattered across the globe; exploration teams generate a stream of numbers which must be constantly summarized and evaluated to yield the probabilities involved in continuing their investigations. Yet accurate and immediate appraisals of these probabilities are crucial to the success of the company's oil discovery program.

Each producing well is, at the least, a source for volume data and each field crew a source for materials and payroll expense data. Properly reduced, this information provides a basis for payments of ownership interests, the distributions of earnings and expense among partners, and ultimately the measurement of operating effectiveness in the producing areas. In addition to the problems of collecting and reducing the detail data for these functions, each application demands adequate and immediate reporting to local as well as to central management.

Since electronic techniques inherently suggest a higher degree of centralization than is possible in the production field, most companies are prudently selecting applications from the wide range of problems which face them. Noteworthy progress has been made in applying electronic computing to the selected problems, and considerable effort is being expended to develop improved data

links which facilitate the solution of additional problems.

Costs of Electronic Computers. Electronic data processing machines are actually composites of a number of separate units. Apart from the central computing unit, more or less auxiliary equipment may be needed depending on the capacity desired for the system. For example, a large number of magnetic tape units, card readers, card punchers and prints, may be operated under the control of one central computing unit. Costs may thus vary widely according to the complement of auxiliary equipment chosen.

Large scale high speed data processing systems may be leased at rentals from $20,000 to $35,000 per month; if outright purchase is possible prices can range to $1.5 million.

Similar variations in cost are possible with most medium scale moderate speed machines. Rentals of these magnetic drum central computing units and a variety of auxiliary equipment may range from $3500 to $12,000 per month, and again where purchase is possible prices may easily range to $300,000.

A series of much smaller machines available at rentals of $300 to $2000 per month and sales prices to $60,000, are generally restricted in size and find application only to select tasks in the oil industry.

The choice of a particular system is, of course, not based on price alone. Each system possesses advantages and disadvantages for given applications. Determination of what equipment will best serve an organization requires detailed attention to performance of major tasks. In addition to careful internal study, proposals may be requested of several manufacturers covering several major applications. The question of what applications are most adaptable to computer operation is necessarily primary.

Common Applications. The following applications have aroused the most widespread interest in production accounting areas:

1. Crude oil run tickets and gas meter charts data—correction to net.
2. Division of interest payment.
3. Expense distribution to leases.
4. Partnership statements.
5. Materials and supplies control.

And in general accounting for this area, payroll and associated insurance and saving plans are among the first electronic computer applications. Alternative: Three problems in production, namely: C. O. ticket runs, gas meter chart, data, division of information and royalty payments, are currently being worked mostly on small computers.

Properly wired panel board is being installed in a computer preparatory to running a production calculation. In addition to production engineering problems, operating and accounting departments make use of the machines to cut computing time.

However, since these particular operations possess features which make them especially applicable to medium sized magnetic drum machines, probably more companies will convert problems to that machine in the near future.

The gas meter chart data, while of somewhat smaller volume than oil, are said to require eight passes through the small computer, which may account for the large number of companies still handling them manually. Considerable improvement over this factor appears possible with the magnetic drum machine.

Research and development departments are making important gains with the aid of electronic computers. Much of the information in this area is, of course, regarded as confidential. However, the following can be cited as some of the more general problems which have been handled by computer systems:

1. Well logging data analysis.
2. Seismographic data analysis.
3. Reservoir studies.
4. Diffusion studies.
5. General application of optimization techniques to geologic survey, allocation of capital and other problems.

The last item corresponds to problems in operations research which have been commanding increased attention in electronic programs. More than half of the organizations interviewed have an operations research group operating in either the treasurer's division, research and development department, or in one or more

of the operating departments. These groups bear a variety of names but each is characterized by the inclusion of mathematicians and scientists capable of constructing manageable mathematical models of operating problems, and deriving solutions for these.

Case Studies. Following are two case studies, each of which reflects an individual company's approach to the development of an electronic computer program. Neither is represented as a best approach, but merely demonstrate how two major oil companies have conducted their preliminary work on the problem.

Company A

Policy Coordinating Committee—Early in 1955 Company *A* formed a policy coordinating committee for computing. This group numbers eleven members, including the controller and personnel selected from the nation-wide organization as follows:

2—Subsidiary No. 1
2—Subsidiary No. 2
1—Marketing Research
5—Operating departments—National

As a policy group, the committee's work is intended to accomplish the coordination of computing programs throughout the company and the collection of key problems for computation from the operating areas. As such problems are formulated, full-time task forces are assigned to carry out detailed investigations. The studies of these task forces constitute guidance for recommendations to top management.

Background—The pioneering work of the research and development departments with small computers and more recently with magnetic drum computers, has provided additional stimulus to company-wide interest. From an operating point of view the important results yielded by these latter machines raised a challenge. Refinery research and development has used its computer for refining process development, catalyst research, reactor design, crude oil analysis and gasoline blending. Trained engineering personnel are relieved of tedious calculating tasks and permitted to undertake a greater variety of problems. The planning department can with this equipment handle more complex process and economic problems, confident that the answers they achieve are more nearly optimal.

Subsidiary No. 1—In accounting, new operations conducted by Subsidiary No. 1 are exciting company-wide interest. This organization, a major subsidiary of Company *A*, like other parts of the company has actively employed punched card equipment for 20 years. During this period the company at one time or another used several different types of small computers and has processed an average of 2,500,000 cards per month for many years. In keeping with this trend the company accepted delivery of a medium sized drum computer in mid-1955 and is considering expanding it with tape units and/or acquiring a large computer for 1957.

Local Committee Work—Under the leadership of the chief tabulating accountant a working committee was formed in early 1955. It numbers three people from accounting, including the chief tabulating accountant and one mathematician from the research laboratories. The committee is intimately familiar with present methods and possesses the required range of skills to assume varied problems.

To encourage interdepartmental use of the machine and to create a suitable climate of work for subsequent equipment, a local policy committee includes the assistant controller, assistant to the vice-president, chief refinery accountant and a representative of the director of research. An additional member will be added to represent petroleum and gas engineering and the geophysical department. The chief tabulating accountant acts as liaison between the working and policy committees and is also officially technical advisor to the policy committee. This committee meets at the request of the working committee.

Company *A*'s policy coordinating committee includes two members of the subsidiary's committee, the research laboratory mathematician and the chief tabulating accountant. Liaison between the local and national policy committees is thus maintained.

Current Status—The company's medium sized computer has performed excellently thus far. In its short operating history 196 hours of working time at 14 hours per day were divided as follows:

88 hours of testing and debugging programs.
40 hours in routine production.
32 hours on special problems.
23 hours in demonstrations.
13 hours in all maintenance.

Applications—Applications now going onto the medium sized computer include:

- Calculation of tank tables and checking out of increment decks.
- Crude oil run ticket calculation (feet and inches gage to net barrels and gross value).
- Division of interest and calculation of taxes and company earnings.
- Casing head gas charts data reduction. (This work is carried through to the preparation of data for two reports by different correction methods, i.e., contract and government. The same runs also yield two important laboratory reports and information for gas development).
- Casing head gas royalty and working interest payments.

It is possible that optimum programming techniques not applied till now can increase output from the present 45 tickets per minute to 90 tickets per minute.

The above problems together with the following were economic justification for the medium-sized computer:

- Calculation of natural gas reserves, a periodic job.
- Depletion reports.
- Part interest accounting.

Beyond these, investigations are under way for performing oil reserve calculations, a number of economic studies, production and geophysical research work which has become too routine for the research machine. For marketing, planning includes testing out electronic data processing techniques for bulk station accounting, although the total volume of this operation vastly exceeds the capacity of the medium-sized computer and is being planned for a large computer. Another report, which compares sales activity with budgeted activity on a month-to-month basis, is already being prepared for marketing on the medium computer.

Company B

General interest in electronic computers and applications at Company *B* has thus far centered in the controller's and research and develop-

ment departments. On a management level, the assistant controller and the manager of the methods division attended numerous computer meetings and visited several installations around the country. On a staff level, four members of the methods staff participated in a four-day computer school presented for the research and development staff.

Recommendations to Top Management—An unofficial committee consisting of the controller, his assistants and the methods manager met in an effort to resolve the course of future computing activity. This informal meeting produced the recommendation that a working group of five people, reporting to the controller, be formed to pursue the subject intensively. Personnel for this group were tentatively selected from present staff to include a man thoroughly experienced in business and accounting methods as practiced in the production and pipe line divisions, a representative from the computer manufacturer, a reservoir engineer, a manufacturing man, and a representative from the research department.

A budget for the working group of between $50,000 and $100,000 was suggested to cover expenses of training in computer systems, programming and preliminary study of major problem areas in the operating departments.

Among the important applications proposed for study are marketing accounting (over 1000 small bulk plants prepare source data for several large regional offices), sales analysis and forecasting, crude oil and gas accounting, production cost distributions, royalty payments and refinery cost accounting and inventory control.

Final recommendation of the meeting was the formation of a high level policy committee to report to the president and guide the development of computing applications.

Research and Development Computer Activities—Company *B*'s research and development department organized their computer center early in 1955. Headed by a capable mathematician and staffed with six people, the center performs a service function for other research sections and assists as consultant on computational problems to other areas in the company. Earlier requirements for computer services in research had generally been met individually by contracting for special services with service bureaus. Such services will now be performed by the center, which will also coordinate other computer activities under way in the department.

The medium-sized computer is providing a powerful computer facility for the research department. Among the more routine research applications for the machine are:

- Generation of departure curves for well-logging operations.
- Diffusion analysis.
- Auto-correlation and correlations of seismic data.
- Process analyses and design.
- Spectroscopic and X-ray data reduction.

The computer center is also providing a strong stimulus to the development of a series of "operations research" projects for the operating areas. One highly successful economic study completed for marketing was the selection of an optimum expansion program for an important pipe line and terminal system. The analysis involved conveying products from a small number of refineries along nearly 50 projected or existent pipe lines to as many as ten terminals and over 200 towns in a given geographic region. The plan chosen was shown to best utilize available capital and yield maximum profits from the operation.

Equally fruitful activities in "operations research" are devoted to other areas. In the refinery, simulations of unit operations are being attempted with analytic functional relationships between operating and product variables. This, rather than a statistical approach, promises to permit linearization of the equations for actual analysis. Again in marketing, linear programming is being applied to a multi-product distribution problem involving several warehouse sites, and a number of plants. In maintenance, scheduling of operations and manpower allocations are being organized with the aid of "waiting line" theory. In each case, work is being directed to an optimal employment of resources. **—The End.**

About the Authors

Rubinfien

Lewis

DAVID RUBINFIEN is managing consultant with general responsibility for all electronic installations made for Arthur Young & Co., Chicago. Prior to joining this company, Rubinfien had complete supervision over all tabulating, electronic, and operations research studies including special purpose research problems, for a major research institute. He received his B.A. degree in 1942 from the University of Illinois. From Illinois Institute of Technology, he received his M.S. degree in mathematics in 1948 and completed partial requirements for his Ph.D. degree. He also received his M.S. degree in business administration in 1955 from the University of Chicago.

•

RALPH F. LEWIS is a general partner with Arthur Young & Co., New York, where he directs the firm's management consulting activities. Prior to this he was associated with a consulting firm, was a special agent for the Federal Bureau of Investigation, was associated with an industrial controllership and was assistant managing editor of *Fortune* magazine. He received his B.A. degree from Amherst College, and his M.S. degree in business administration from Harvard College Graduate School. He is also a Certified Public Accountant, and a member of the American Institute of Accountants.

FIGURE 1—As the temperature of an oil rises, the vapor pressure increases and must have unblocked relief or pressure rupture may occur. There is no flame arrester in the opening of this drum.

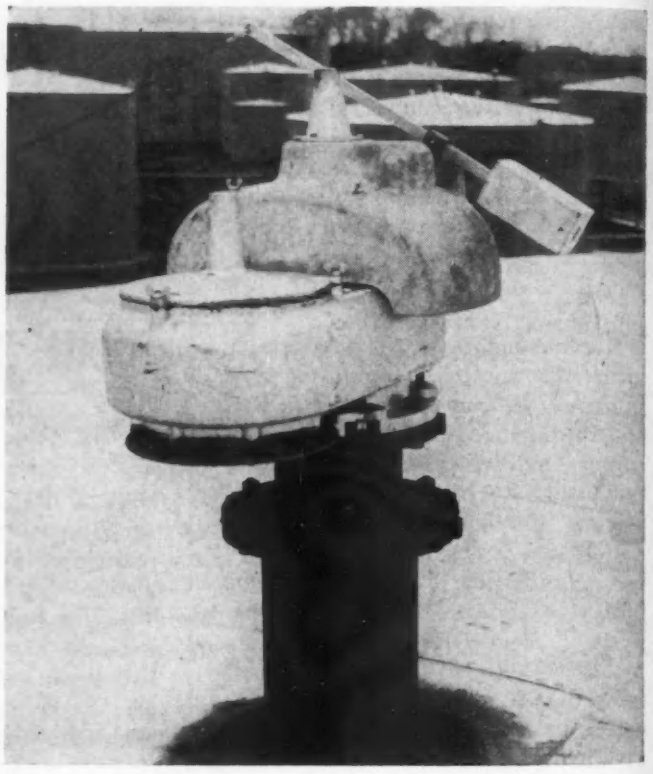


FIGURE 2—Conservation vent with no flame arrester bank. Flame arresters are not needed on approved conservation vents. They are themselves effective flame arresters, as well as vapor conservation devices.

Safety and Fire Protection—Part 2

How to Prevent Crude Oil Tank Fires

In this thorough summary of crude fire prevention are many excellent pointers on the proper use of flame arresters, prevention of boilover and slopover, safeguards against lightning ignition and the use of the right kind of tanks.

By J. L. RISINGER
Maplewood, N. J.

FIRE DIFFICULTIES, inherent in the characteristics of crude oil when stored in tanks or pools, are rapidly being overcome by:

- More effective means of handling the slopover characteristics of crude.
- Improved fire extinguishment methods.

These two avenues of progress in crude oil fire prevention and control are reflected in the following industry developments:

Using the Right Kind of Tanks—All steel gas tight correctly vented tanks are not subject to lightning ignition. The cause of fire is limited to spontaneous ignition from iron sulfide accumulation above the liquid level from storage of high sulfur crude, exposure to fire from outside sources and to large spill fires around the tanks.

By the use of conservation vents on low flashpoint cone roof crude tanks, iron sulfide formation is usually kept dampened with vapor and therefore inactive. Thus, the fire problem is limited to times when the tank is out of use. Attention should always be given to preventing the drying out of tanks having contained high sulfur content crude.

In the case of storage exclusively of sweet crude oil in a tank, iron sulfide ignition is eliminated.

The floating roof tank, in addition to conserving crude oil vapor, has limited crude fires to a few lightning ignited rim fires that were easily put out. With some corrections even this cause can be eliminated.

In short, the greatest factors in solving the tank fire

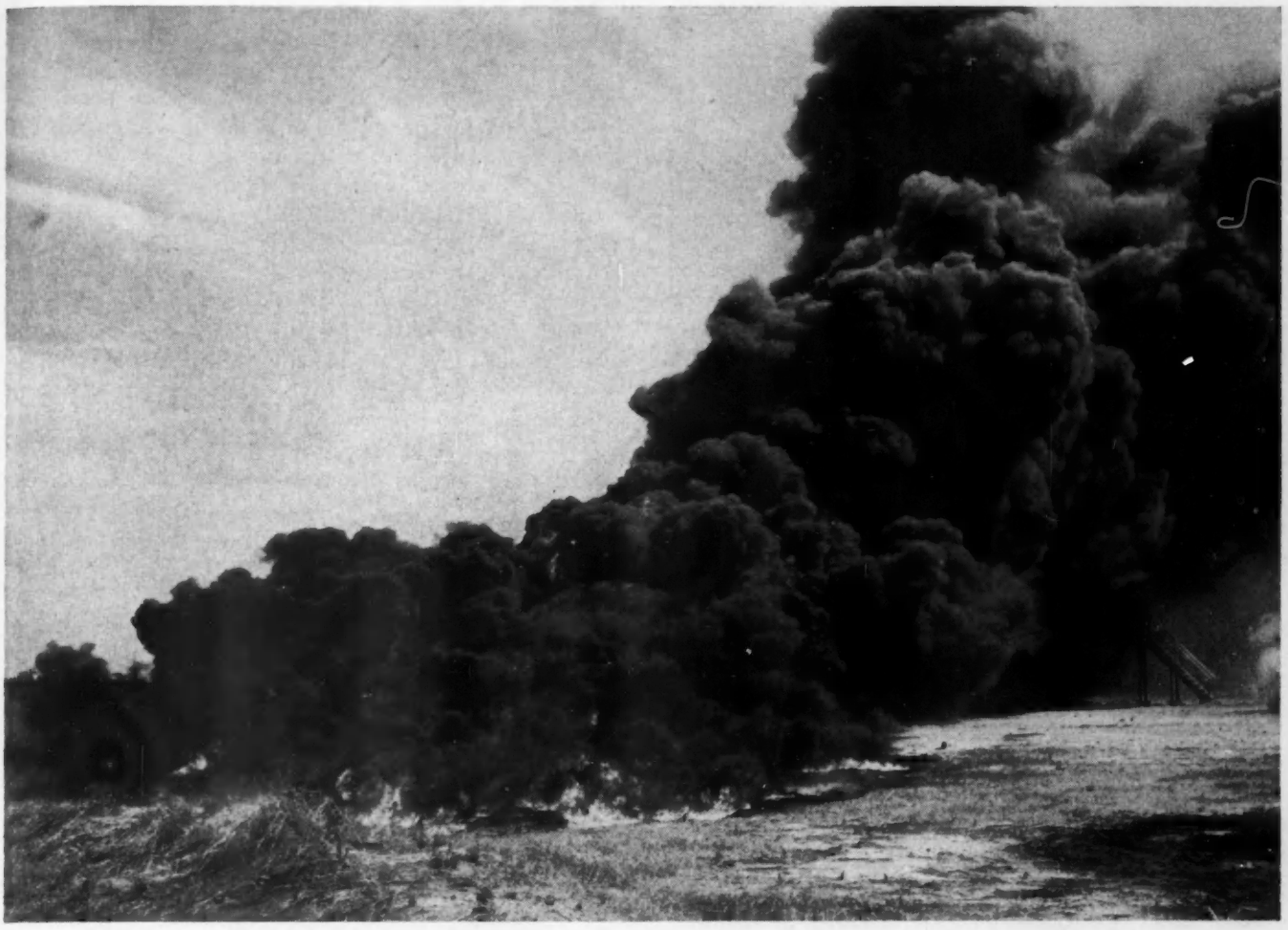


FIGURE 3—In this air agitation test, application into a four-inch water bottom caused the crude to boil over after 1½ hours of burning. A similar tank with the same oil had a heat wave about 50 percent of the depth of the oil.

problem is a correct tank and keeping the tank correct through proper maintenance.

Proper Use of Flame Arresters and Vents—Flame arresters are not required and have no purpose on an approved conservation vent. They are required on open vents of crude oil tanks of over 3000 barrels capacity and containing crude oil with a flashpoint below 70 F. (See National Fire Protection Association ordinance, No. 30-L, May, 1954.)

In no case is a tank required to have both the approved conservation vent and the approved flame arresters. The opinion is expressed that neither vents nor arresters are justified on all steel gas tight tanks. However, the approved conservation vent is well justified on tanks containing low flashpoint crude oils to help prevent loss of vapors.

Flame arresters on these vents are not required and cannot be justified in the light of oil industry experience. They greatly reduce the venting capacity, are difficult to keep from clogging, may cause a tank roof rupture and their cleaning and upkeep presents a problem in any climate.

Provisions for Spill and Overflow Control—Increased dike capacity is no insurance against spread of fire from boilover of crude oil. More attention should be given to modern methods of preventing the fire and extinguishment without slopover. Also, the fires must not be permitted to burn to a boilover.

Some regulations provide that tanks or groups of tanks containing flammable liquids be diked or other suitable means taken to prevent spillage or overflow of liquid. With present methods for extinguishment of crude oil tank fires, no extra provisions are indicated above that of refined oils.

Where terrain is suitable, the trend is toward channeling of liquid to an area where spillage or overflow will not become ignited and fires can be extinguished or allowed to burn. This method is replacing the diked enclosures in many instances.

Diversion dikes are used where necessary to direct the flow to open depressions, ditches or closed drainage systems. For specifications where diked enclosures are required, see National Fire Protection Association Handbook 30-L.

Added Requirements for Crude Oil Storage Tanks—Crude oil tanks in or near refineries are either all steel gas tight correctly vented or floating roof tanks. Therefore, the incidence of fires to these tanks is remote.

Should one of these cone roof tanks blow the roof and catch fire, it can be put out with portable equipment before a slopover heat wave develops. There is no reason why one of these cone roof tanks should be permitted to

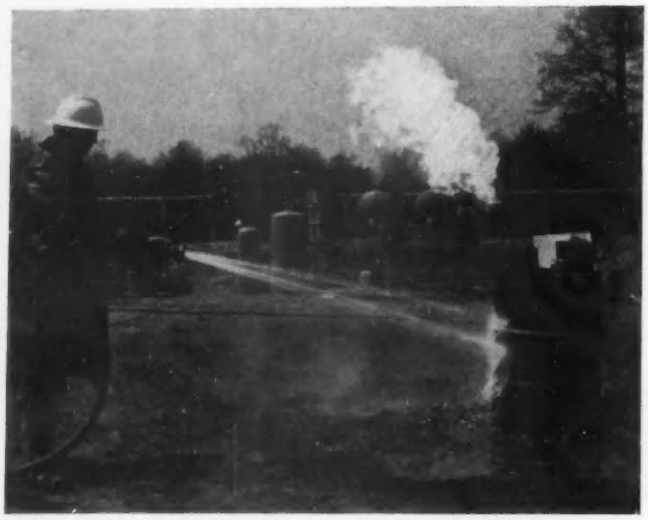


FIGURE 4—When the fire around this gasoline drum was extinguished and the drum cooled, the fire went out, not down into the drum.

burn to a boilover. Therefore, it is difficult to justify expensive added requirements on all tanks containing crude oil subject to boilover above the same type tanks containing refined oils which are not subject to boilover.

Wood and Composition Roofed Crude Oil Tanks—In isolated locations, a number of wood and composition roofed crude oil tanks are still in use. Also, there are some corroded and otherwise bad order steel roofs that are neither gas tight nor lightning proof.

Such tanks are subject to ignition either by lightning or iron sulfide spontaneous ignition. With the exception of floating roof rim fires, practically all crude oil tank fires of recent years have resulted from tanks of this type and condition. Furthermore, these tanks are so located that the providing of effective fire fighting devices and systems would be very costly and are not justified. In many cases these tanks are permitted to burn to a boilover.

There are two ways to prevent lightning ignition of wood and composition roofed crude oil tanks. One method is known as the Farady Cage. It consists of steel uprights welded or bolted to the shell of the tank at intervals around the tank. Wires between these uprights shield the roof from lightning strike.

Another method is the erection of masts that provide a cone of protection to tanks around it. For a more complete description of these methods, see "Code for Protection Against Lightning," National Bureau of Standards Handbook H40, Part III, Sept., 1944.

The best program for prevention of lightning ignition of these roofs is to replace them with all steel cone roofs or correct floating roofs.

Surface Static and Crude Fires—Experience and tests indicate that a static charge will not accumulate on the surface of crude oil faster than it can normally bleed off to the shell of the tank as may occur in refined products from pumping in turbulence. Therefore, surface static cannot be assigned as one of the causes of crude oil tank fires.

The Problem of Boilover—With the all steel gas tight tank, the floating roof tank and modern methods of putting out crude tank fires, the problem of boilover has been reduced to isolated tanks. In many of these latter cases, the tanks are not lightning proof and the cost of fire extinguishment equipment cannot be justified.

To prevent one of these tanks from boiling over it would be necessary to change the heat wave characteristics of the oil, change its viscosity, or eliminate the water before the heat wave reached it. Evidently, the only one of these that could be removed is the water.

Of course, the tank could be built so that all of the water would drain to one point from which it could be pumped out. This might be cheaper than an all steel gas tight, or floating roof tank.

Use of Agitation Methods to Prevent Boilover—Agitation of crude oil by adopted air agitation specifications will not remove a heavy water bottom before the total oil reaches the boilover temperature of water. Where no water bottoms are carried and oil is kept mixed by special devices or air, boilover can be prevented.

If agitation methods are to be used successfully, the water at the bottom of the tank must be rolled up and steamed out at the surface before the total quantity of the oil reaches a temperature above the boiling point of water.

Recent tests indicate that with an appreciable water bottom this will not occur when air is injected according to the air agitation specifications designed to extinguish or control tank fires. In some tests the boilover was delayed and in some it was speeded up. In some instances the boilover appeared to be less violent and in others it was more violent.

Where mixers are installed in the tanks and there is no accumulation of water and emulsion on the bottom of the tank, agitation with devices or air will keep the water from settling to the bottom in sufficient quantity during its burning to cause a boilover.

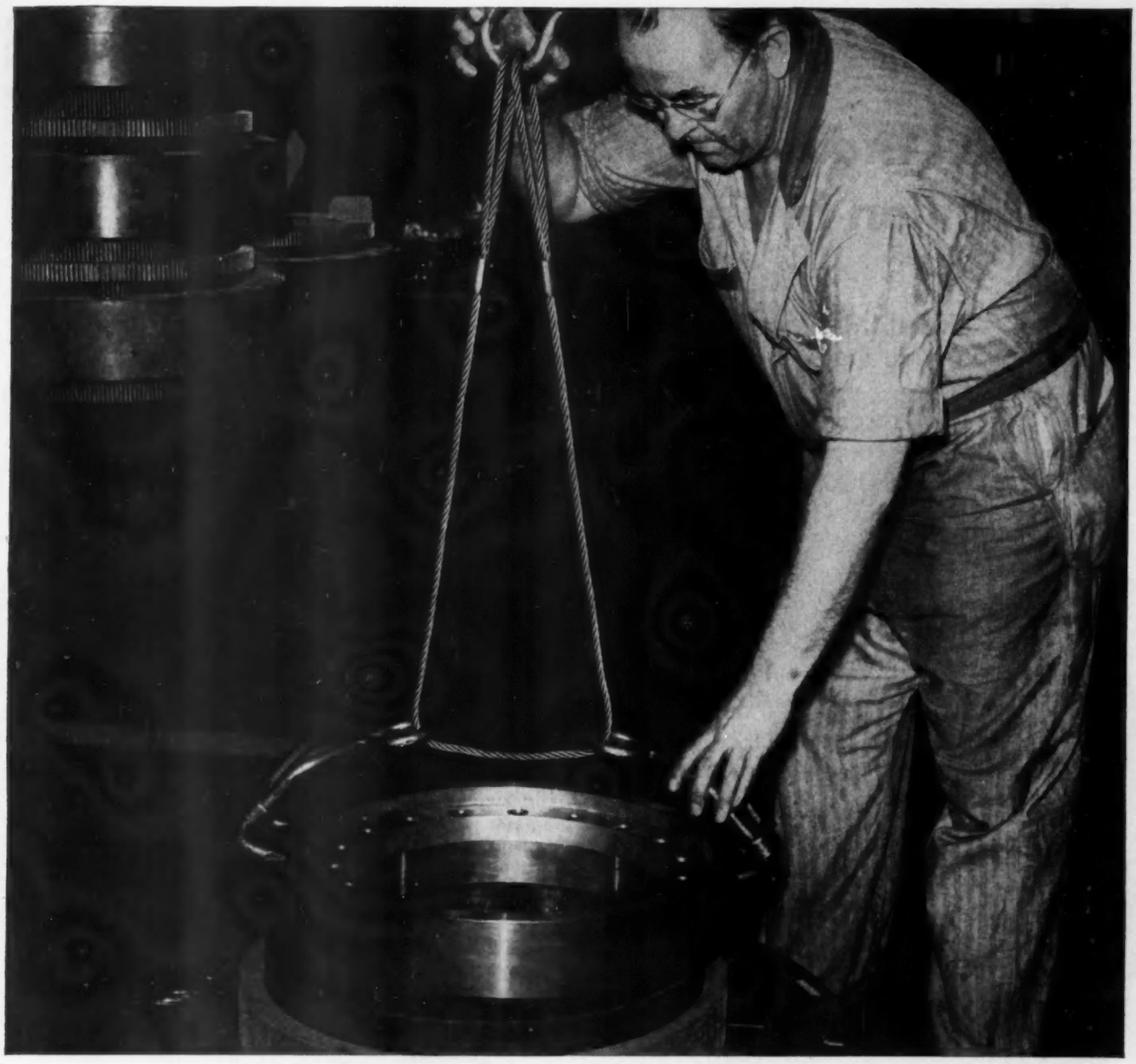
In the case of fire in crude oil tanks the object is to save all the oil possible before it gets too hot to pump. Whether the oil can be pumped longer under agitation is not known. If there is a high heat wave travel rate, it is possible that agitation would allow more oil to be pumped. However, in the case of a slow heat wave travel rate the use of no agitation until the heat wave reaches the pumping out suction might allow the oil to be pumped longer.

These deductions are from a study of heat input when crude oil was burning under agitation control and tests on slow heat wave rate crude oil burning without agitation.

The oil industry is proceeding on a program which will continue to reduce the boilover problem to practical elimination. This will be accomplished by storing crude oil, even in isolated locations, in tanks which do not become ignited and in which the fire can easily be extinguished with portable equipment.

Many small tanks have already been provided with extinguishing materials such as dry chemicals. These chemicals can be applied with portable devices and do not cause slopover regardless of the heat wave depth.

Part 3 will appear in the April issue of WORLD OIL



So Many Products from These Husky Steel Blanks

If some of your products require the use of circular steel parts, then Bethlehem's forged-and-rolled blanks should be of unusual interest to you. For Bethlehem makes blanks by a method that forges and rolls the steel in a single operation, thus insuring uniform density, excellent grain flow, and very high strength. It is a process unduplicated by any other manufacturer.

For many years customers have used these strong steel blanks in making gears, crane wheels, end rings, sheave wheels, turbine rotors, flywheels, tire molds and rings, pistons, clutch drums, and similar parts. Because of the high strength inherent in the blanks, it is often feasible to employ thinner-than-usual sections. This means a saving in weight. And machining can be done so dependably that there is almost never a reject.

Bethlehem blanks come in a wide range of sizes—approximately 10 to 46 in. OD. They can be furnished heat-treated or untreated. And they are competitive pricewise, so that you can use them without increasing your costs.

Full details will be furnished by the Bethlehem office nearest you. Write for complete information.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Free Oil Industry Spends $56 Billion in Ten Years

Two thirds of world-wide capital expenditures in 1946-1955 were made in U. S. and one third in other free countries.

Funds were used this way: 59 percent for production facilities, 16 percent for refining, 13 percent for transportation and 12 percent for marketing.

Gross investment in fixed assets grew to $63 billion at the end of 1955 from $23 billion at the close of 1945.

By FREDERICK G. COQUERON and JOSEPH E. POGUE
Petroleum Department of Chase Manhattan Bank
New York City

IN THE TEN YEARS following World War II, 1946-1955, the petroleum industry of the Free World carried out a vast and costly program of replacing and expanding its facilities. Capital expenditures of $56 billion were made.

Of those funds, about $38 billion or 68 percent went for properties and plants in the U. S. In foreign free areas the expenditures for facilities amounted to $18 billion, or 32 percent of the total.

Those totals indicate that during the decade the capital expenditures averaged $5.6 billion per year. They included averages of $3.8 billion annually in the U. S. and $1.8 billion per year in other free countries.

Of the total expenditures, 59 percent went into production department facilities. Proportions devoted to other departments of the business included 16 percent of the total for refining, 13 percent for transportation facilities, and 12 percent for marketing.

Gross Investment Grows. As a result of the heavy capital expenditures in the postwar decade, the *gross* investment in *fixed* assets employed by the Free World oil industry increased greatly. It grew to $63 billion at the end of 1955 from $23 billion at the close of 1945.

This increase of about 2.6 times in fixed assets within 10 years was made in response to a doubling meanwhile of Free World petroleum consumption. That use increased to 14.4 million barrels per day in 1955 from 7.1 million daily in 1946.

Of the $63 billion of gross investment in fixed assets at the end of 1955, over $40 billion or 64 percent was located in the U. S. The remainder of $23 billion or 36 percent represented facilities in foreign free areas.

The $63 billion Free World gross investment December 31, 1955, included 48 percent in the production department, 20 percent in refining, 17 percent in transportation, and 15 percent in marketing.

Of the gross investment of $23 billion in fixed assets located in free foreign countries, a total of $8 billion or 35 percent represented holdings of American oil companies.

The $8 billion of gross investment of American companies in foreign free countries at the end of 1955 gave them prominent roles in the industry in most of the major areas of development. The American companies accounted for 54 percent of the gross fixed assets employed in the petroleum industry in Canada at the end of 1955. They held 61 percent of the gross fixed assets invested in the petroleum industry in Venezuela. American concerns accounted for 47 percent of the fixed assets in the industry in the Middle East. They held 26 percent of the investment in facilities in Western Europe. In other free foreign countries they accounted for 22 percent of the fixed assets.

The share of American enterprises in foreign Free World crude oil operations in 1955 was 55 percent of production and 40 percent of refinery runs.

Financing the Costs. During the five years, 1951-1955, the U. S. petroleum industry paid out $24 billion for capital expenditures and other related investments. The expenditures exceeded the $20 billion available from operations. The difference of $4 billion was obtained from external sources, principally the capital markets.

A major share of the funds invested has been provided out of capital extinguishment charges and retained earnings. The industry has been largely self-financing, with contribution from the capital markets limited in amount. This method of reinvestment is deemed essential to support the growth demanded by consumers and is expected to follow the same pattern in the future.

General Welfare Served. The oil business of the Free World has wide ramifications and is extensively interconnected. These characteristics are emphasized by the pattern of flow of petroleum throughout the Free World. They are evidenced further by the international movements of capital linking producing areas and markets.

The far-flung activities of the petroleum industry can be operated efficiently only through the agency of its integrated character. Essential competition can best be preserved through the medium of independent corporate entities.

These enterprises are ideal vehicles for achievement of international cooperation and application of capital and technology to the welfare of all people. This is a remarkable circumstance, seldom appreciated in its full implications.

ACKNOWLEDGMENT

Excerpt from a paper presented before the Petroleum Branch at the annual meeting of the American Institute of Mining, Metallurgical, and Petroleum Engineers, at New Orleans, La., February 27, 1957.

no well is "completed"...

until the vital casing I. D.
has been scraped clean and smooth with a

BAKER
ROTO-VERT CASING SCRAPER

Leaves the important "working surface" of the casing permanently safe for running swabs and testers, and for setting bridge plugs, packers or cement retainers.
★ Can either be rotated or "spudded" to remove hardened rotary mud, the thin sheath of cement left by the bit, and burrs from gun-shot holes. Usually run above the bit to clean the casing while drilling out cement.
★ Available anywhere, anytime; just specify Baker ROTO-VERT Casing Scraper, Product No. 620-C.

BAKER OIL TOOLS, INC. / HOUSTON / LOS ANGELES / NEW YORK

REPORT FROM THE OBSERVATORY

By **RAY L. DUDLEY,** Publisher, and **WARREN L. BAKER,** Editor

Next 60 Days Key to Price Outlook

Recent reduction in gasoline output brightens prospects that surplus motor fuel stocks will be overcome sufficiently for prices to maintain new levels.

The next two months constitute an extremely crucial period of time for the U. S. oil industry. During the coming 60 days it will be pretty well determined whether the industry will succeed in maintaining recently advanced prices of both crude oil and refined products.

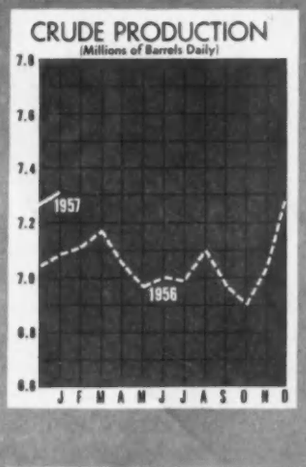
Everything depends on refinery output of gasoline. Due to excessive supply, motor fuel markets are weak, therefore, the key to the whole price structure. All other conditions are favorable.

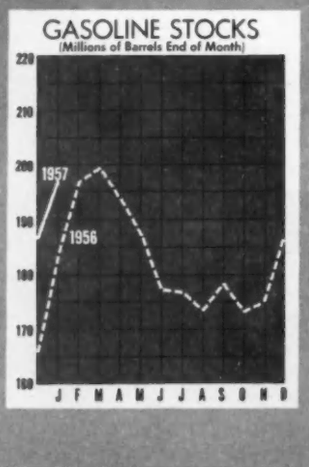
Prospects are brightened by substantial reductions in refinery crude runs and gasoline yields during recent weeks. Vast improvement can be achieved if the industry holds refining operations to recent levels during the next two months. Such action would greatly strengthen the chances of crude and product prices being able to hold their new higher levels.

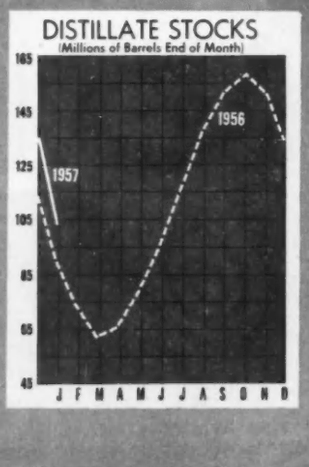
Refinery crude runs dropped to 7,976,000 barrels daily during the week ending February 15. Announced plans of numerous companies to cut refinery runs presage the weeks ahead may see the lowest levels since October and March, 1956. If reduced levels are maintained for two months, they will go a long ways toward curing weak gasoline markets.

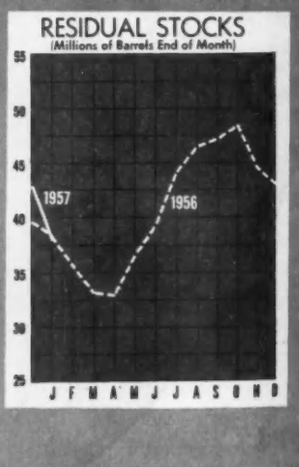
Equally important have been downward adjustments in gasoline yields. Output of motor fuel during the week ending February 15 averaged 3,761,000 barrels daily, lowest since March, 1955. Although crude runs were at an alltime high in January, gasoline yields averaged 3,900,000 barrels per day, or 59,000 barrels less than December, 1956, and 27,000 barrels a day below January, 1956.

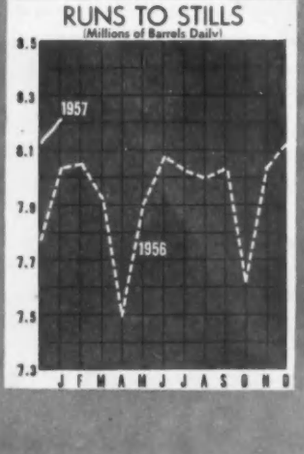
Petroleum Trends . . .

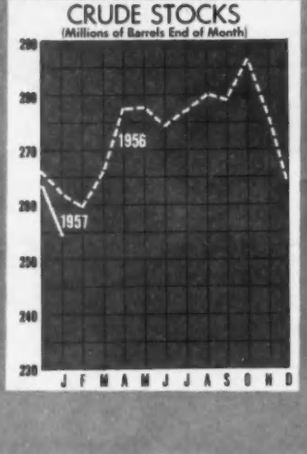


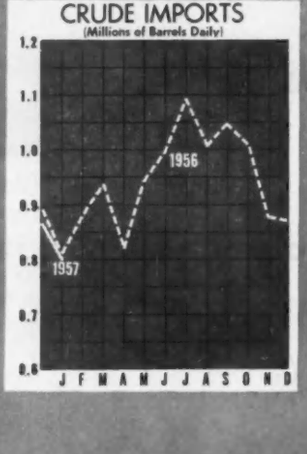


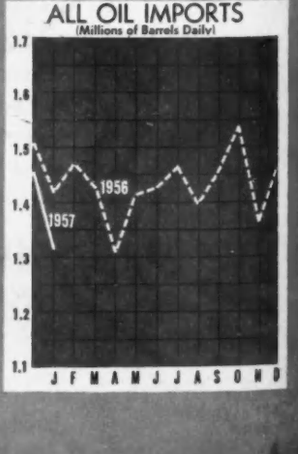












Considerable improvement has taken place in gasoline stocks during recent weeks due to reduced output. Although inventories have continued to rise, they have advanced at a slower rate and now are nearer to year ago levels than anytime in the past 12 months.

Gasoline inventories rose to an all-time high of 202¼ million barrels by February 15. However, at this level they were only 12¾ million barrels above a year ago, whereas they had been 21 million barrels larger than the previous year at the beginning of 1957.

If gasoline output is not permitted to exceed 3,750,000 barrels per day during the six weeks between February 15 and the end of March, stocks can be brought even closer to 1956 levels.

Inserted as a special supplement to this issue of WORLD OIL is a graphical report on the oil price situation giving detailed background facts.

Crude is in good position, with stocks the lowest in several years. Despite record crude production in January and early February, they have continued to decline. They totaled only 251 million barrels on February 9, or 36 million less than at the end of October.

Although production in March will be far larger than ever before, the crude market will not be jeopardized. Even if reduced refinery crude runs results in additions to stocks, there is no immediate danger because crude inventories need to be increased to around 265 million barrels.

However, this does not mean that crude production can be maintained indefinitely at its forthcoming high March volume. Crude needs will drop sharply in the second quarter of the year. Consumption always drops to the lowest level of the year during this period. In addition, producers face the additional factor in 1957 of seeing Europe's call for U. S. crude come to an almost complete halt as Middle East shipments are resumed. Unfortunately, the normal seasonal drop in requirements will come simultaneously with the slackening of European demand for U. S. crude.

However, the crude stock position is in such excellent condition, reasonable care can keep producing rates in line with fluctuating requirements although fluctuations in 1957 will be much sharper than usual.

U. S. Crude Production by States

(THOUSANDS OF BARRELS)

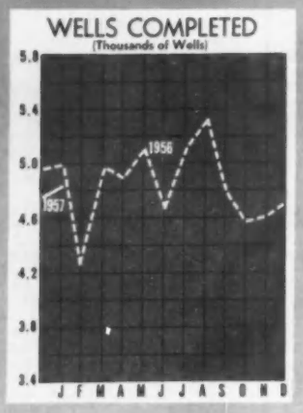
STATE or DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL PRODUCTION		
	Jan., 1957	Dec., 1956	Jan., 1956	% Diff. Jan., 1956-1957	Jan., 1957	Jan., 1956	% Diff. 1956-1957
Alabama	11.5	11.0	4.9	+135.8	356	151	+135.8
Arkansas	80.2	78.1	76.0	+ 5.6	2,480	2,356	+ 5.6
California	943.5	948.4	971.5	— 2.9	29,249	30,116	— 2.9
Colorado	159.7	158.9	157.6	+ 1.3	4,950	4,886	+ 1.3
Florida	1.2	1.3	1.4	— 9.3	39	43	— 9.3
Illinois	234.4	238.2	224.7	+ 4.4	7,268	6,964	+ 4.4
Indiana	32.6	32.6	27.5	+ 18.8	1,007	848	+ 18.8
Kansas	336.6	338.4	338.6	— 0.6	10,437	10,498	— 0.6
Kentucky	48.2	47.2	47.1	+ 2.3	1,494	1,461	+ 2.3
Louisiana	978.1	970.1	794.9	+ 23.0	30,320	24,643	+ 23.0
North Louisiana	131.4	131.1	124.5	+ 5.5	4,071	3,960	+ 5.5
South Louisiana	846.7	839.0	670.4	+ 26.3	26,249	20,783	+ 26.3
Michigan	26.6	27.7	30.1	— 11.9	823	934	— 11.9
Mississippi	113.8	114.3	111.1	+ 2.5	3,530	3,443	+ 2.5
Missouri	0.2	0.2	0.2	.....	5	5	.....
Montana	69.2	68.5	54.8	+ 26.4	2,146	1,698	+ 26.4
Nebraska	38.5	38.6	36.3	+ 6.0	1,193	1,126	+ 6.0
Nevada	0.1	0.1	0.2	— 57.2	3	7	— 57.2
New Mexico	249.0	243.7	247.5	+ 0.6	7,719	7,674	+ 0.6
Southeast New Mexico	246.4	241.7	244.5	+ 0.8	7,640	7,582	+ 0.8
Northwest New Mexico	2.6	2.0	3.0	— 14.1	79	92	— 14.1
New York	7.0	7.5	7.5	— 6.9	215	231	— 6.9
North Dakota	38.8	38.0	44.3	— 12.4	1,204	1,374	— 12.4
Ohio	12.2	12.3	12.3	— 1.3	377	382	— 1.3
Oklahoma	613.2	609.4	609.9	+ 0.6	19,012	18,907	+ 0.6
Pennsylvania	21.7	21.9	23.1	— 5.7	674	715	— 5.7
South Dakota	0.1	0.1	0.1	.....	1	1	.....
Tennessee	0.1	0.1	0.1	.....	1	1	.....
Texas	3,078.1	3,059.2	3,077.4	.....	95,422	95,400	.....
Dist. 1: South Central	56.6	56.0	48.9	+ 14.7	1,736	1,514	+ 14.7
Dist. 2: Middle Gulf	154.3	153.4	161.5	— 4.4	4,784	5,006	— 4.4
Dist. 3: Upper Gulf	459.6	457.9	454.8	+ 1.0	14,247	14,099	+ 1.0
Dist. 4: Lower Gulf	236.8	236.6	247.7	— 4.4	7,342	7,679	— 4.4
Dist. 5: East Central	39.8	39.8	46.6	— 14.4	1,234	1,442	— 14.4
Dist. 6: Northeast	343.2	341.3	356.7	— 3.8	10,638	11,058	— 3.8
Dist. 7-B: North Central	161.9	159.2	150.4	+ 7.7	5,020	4,662	+ 7.7
Dist. 7-C: West Central	171.6	170.0	174.1	— 1.4	5,322	5,396	— 1.4
Dist. 8: West	1,143.9	1,130.6	1,013.9	+ 12.8	35,460	31,431	+ 12.8
Dist. 9: North	209.4	208.5	197.1	+ 6.2	6,490	6,111	+ 6.2
Dist. 10: Panhandle	101.6	105.9	92.2	+ 0.2	3,150	2,858	+ 0.2
Utah	10.5	8.6	6.0	+ 74.3	326	187	+ 74.3
Virginia	0.1	0.1	0.1	.....	1	1	.....
West Virginia	5.8	5.3	5.7	+ 2.2	182	178	+ 2.2
Wyoming	300.7	296.2	288.1	+ 4.4	9,322	8,930	+ 4.4
TOTAL UNITED STATES	7,411.7	7,376.0	7,199.0	+ 3.0	229,764	223,160	+ 3.0

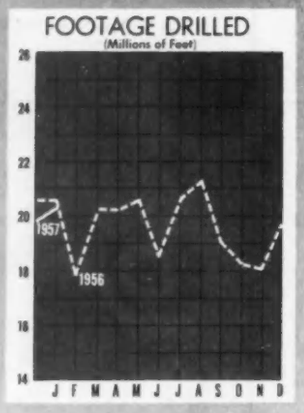
U. S. Crude Oil and Refined Product Trends

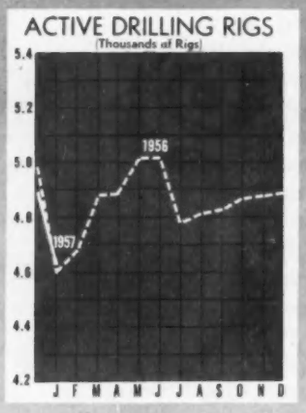
(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1955:											
June	6,613	7,484	270,850	3,725	157,439	1,628	100,652	1,080	44,398	764	1,159
July	6,632	7,580	264,601	3,824	157,079	1,575	119,169	1,091	44,894	860	1,161
August	6,665	7,580	256,427	3,858	151,912	1,621	133,675	1,090	45,480	756	1,155
September	6,731	7,483	256,269	3,784	150,194	1,621	143,248	1,061	46,267	829	1,218
October	6,831	7,465	267,346	3,827	153,103	1,612	152,288	1,123	47,040	821	1,206
November	7,014	7,692	260,707	3,867	157,871	1,680	141,808	1,214	44,071	823	1,322
December	7,155	7,762	265,610	3,916	165,433	1,765	111,333	1,286	39,174	884	1,502
1956:											
January	7,199	8,023	261,592	3,927	183,905	1,923	86,141	1,344	38,247	805	1,422
February	7,208	8,047	259,504	3,854	196,092	1,918	71,335	1,286	35,673	878	1,472
March	7,278	7,914	265,683	3,829	199,698	1,808	63,846	1,213	32,984	934	1,425
April	7,146	7,487	277,121	3,646	193,299	1,713	63,571	1,130	32,740	815	1,305
May	7,064	7,896	277,497	3,859	186,673	1,667	75,928	1,149	36,607	928	1,416
June	7,100	8,071	274,491	3,976	177,076	1,755	93,758	1,098	39,073	937	1,426
July	7,090	8,014	277,008	3,975	176,536	1,767	115,787	1,066	43,958	1,084	1,463
August	7,195	7,995	279,944	4,037	172,939	1,839	137,905	1,091	46,617	1,001	1,399
September	7,054	8,024	278,791	3,991	177,974	1,845	150,411	1,062	47,342	1,043	1,452
October	6,966	7,608	286,560	3,773	172,798	1,772	158,871	1,082	48,400	1,004	1,541
November	7,139	8,031	275,995	3,913	174,808	1,841	151,517	1,182	44,590	871	1,362
December	7,376	8,114	263,027	3,959	186,374	1,990	133,742	1,238	42,696	864	1,453
1957:											
January	7,412	8,205	254,048	3,900	196,351	2,077	100,369	1,270	38,212	796	1,317
Week Ended:											
2-8-57	7,461	8,119	250,927	3,912	199,895	2,012	93,516	1,271	37,042	867	1,512
2-10-56	7,046	8,016	253,484	3,700	187,618	1,920	80,569	1,310	37,727	557	1,365

Drilling Activities . . .







January Wells Show Gain But Still Trail '56 Total

By CECIL W. SMITH, World Oil Staff

New wells completed in the U. S. during January represented a small gain over those drilled in December, but even with the increase, the year got off to a slower start than did 1956. It was the third month of slow recovery for the drilling industry, after its operations were cut back sharply by the steel strike-induced pipe shortage in late 1956.

In normal years, February is the low period for drilling, and 1957 will be no exception, but activity is expected to again gain momentum and reach last year's rates. Perhaps even exceed them.

New wells completed in the nation totaled 4808 during January. That was a gain of 1.8 percent over the 4722 recorded in the final month of 1956, but they failed by 5.1 percent of matching the 5065 new wells added in the opening period of last year. So, unlike most previous years that got off to a faster start than their predecessors, the current year will have to play catch-up if the expected drilling peak is reached.

Although January's wells were down 5 percent from the previous year's comparable period, the amount of footage drilled in the month's wells was only 1.5 percent less. An average of 4239 feet was the depth of January's tests, while a year earlier, the average well was taken to only 4083 feet. Footage is a truer measure of drilling activity, but resulting wells is of greater importance to the nation and industry.

Even more important are the new producing wells, and it was in this department that January came close to holding its own. Actually, it came out ahead, percentagewise. Of the month's wells, 2976 were rated as producers, and these amounted to 61.9 percent of the total drilled. A year earlier, a slightly greater 3033-producers amounted to only 59.9 percent of the total. That gave the later period an advantage of 2 percent in batting average.

The 1957 campaign got off in fine style throughout most of Texas, the leading drilling state in the nation. Although the state showed a net gain of slightly more than 150 new wells, it could not offset declines registered in the Mid-Continent and Rocky Mountain regions. Principal hikes in Texas occurred in the Gulf Coast, Western and Northern sectors.

Other leading states enjoying increased activity included Louisiana with a gain of almost 19 percent; New Mexico, where new wells totaled 46 percent greater; and Arkansas with two-thirds more activity.

Principal drops occurred in Illinois, Indiana, Oklahoma and almost every Rocky Mountain state.

Western Canada's drilling suffered more than did the U. S. as a whole. A total of 224 new wells was completed in the prairie provinces, and that amounted to 13.5 percent less than the 259 wells in January, 1956.

Summary of U. S. Drilling Activity

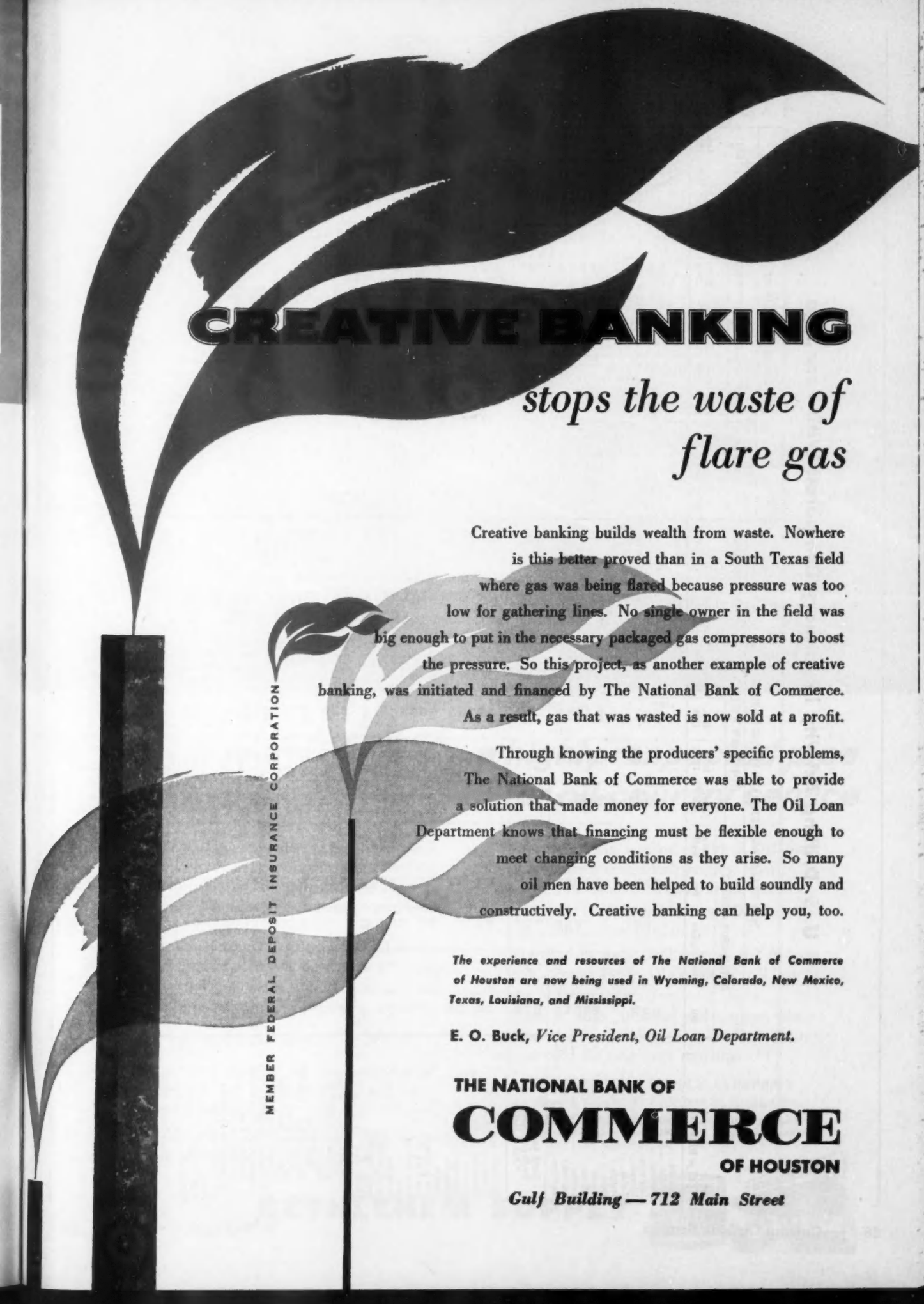
ITEM	Jan., 1957	Dec., 1956	Jan., 1956	% Dif. Jan., 1956-1957
New Wells Completed:				
Oil	2,624	2,349	2,635	— 0.4
Distillate	53	40	42	+26.2
Gas	299	333	356	—16.0
Service	81	94	59	+37.3
Dry	1,751	1,906	1,973	—11.3
Total Wells	4,808	4,722	5,065	— 5.1
Footage Drilled (Mln. of Feet)	20.4	19.8	20.7	— 1.5

(See Page 88 for details)

Summary of U. S. Wildcat Drilling

ITEM	Jan., 1957	Dec., 1956	Jan., 1956	% Dif. Jan., 1956-1957
New Field Discoveries				
Oil	98	81	73	+34.2
Distillate	15	9	8	+87.5
Gas	19	21	21	— 9.5
Total Discoveries	132	111	102	+29.4
Dry Wildcats	940	983	961	— 2.2
Total Wildcats	1,072	1,094	1,063	+ 0.8
Percent Productive	12.3	10.1	9.6	.....
Percent Dry	87.7	89.6	90.4	— 2.3

(See Page 88 for details)



CREATIVE BANKING

stops the waste of flare gas

Creative banking builds wealth from waste. Nowhere is this better proved than in a South Texas field where gas was being flared because pressure was too low for gathering lines. No single owner in the field was big enough to put in the necessary packaged gas compressors to boost the pressure. So this project, as another example of creative banking, was initiated and financed by The National Bank of Commerce. As a result, gas that was wasted is now sold at a profit.

Through knowing the producers' specific problems, The National Bank of Commerce was able to provide a solution that made money for everyone. The Oil Loan Department knows that financing must be flexible enough to meet changing conditions as they arise. So many oil men have been helped to build soundly and constructively. Creative banking can help you, too.

The experience and resources of The National Bank of Commerce of Houston are now being used in Wyoming, Colorado, New Mexico, Texas, Louisiana, and Mississippi.

E. O. Buck, *Vice President, Oil Loan Department.*

THE NATIONAL BANK OF

COMMERCE

OF HOUSTON

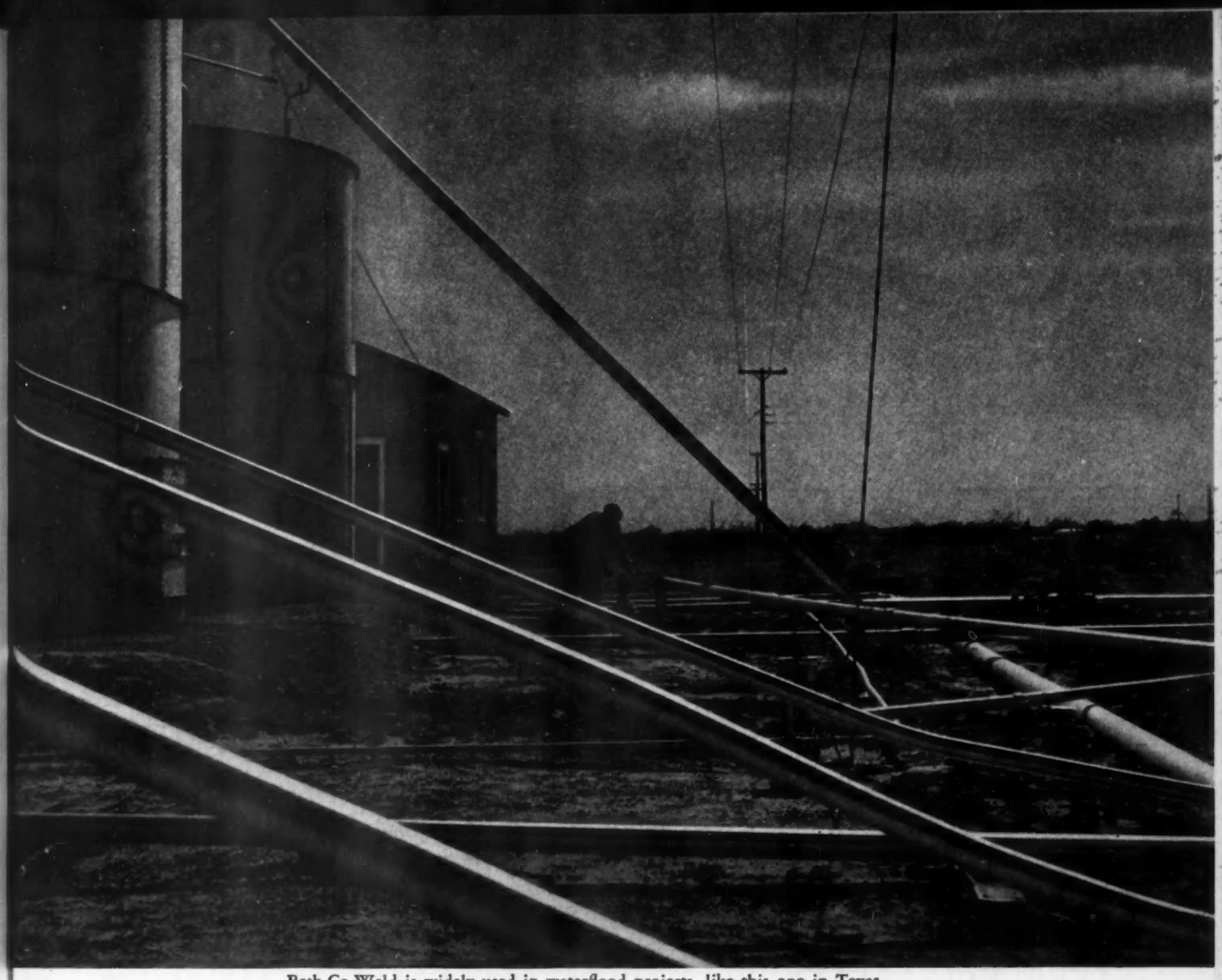
Gulf Building — 712 Main Street

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

U. S. Drilling Activity in January Compared With Year Ago

STATE or DISTRICT	NEW WELLS COMPLETED AND FOOTAGE DRILLED: DETAILS FOR JANUARY Oil	Dist.	Gas	Dry	Service Wells	TOTAL NEW WELLS Jan., 1957	Dec., 1956	Jan., 1956	% Diff. Jan., 1957-1956	TOTAL FOOTAGE January, 1957	January, 1956	WILDCAT DRILLING IN JANUARY: NEW FIELDS IN JANUARY Oil	Dist.	Gas	TOTAL DISCOVERIES Jan., 1957	Dec., 1956	Jan., 1956	DRY WILDCATS Jan., 1957	Dec., 1956	Jan., 1956	TOTAL WILDCAT TESTS Jan., 1957	Dec., 1956	Jan., 1956	DRILLING RIGS IN OPERATION Jan., 31, 1957	Dec., 31, 1956	Jan., 31, 1956
Alabama	2	....	....	....	....	2	3	7	—71.4	23,071	57,421	....	....	....	....	....	....	....	1	1	....	1	1	20	25	10
Arizona	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....
Arkansas	91	....	....	24	....	115	107	69	+66.7	315,919	215,801	1	....	....	1	....	2	11	16	12	12	16	14	66	80	50
California	151	....	2	56	....	209	207	202	+ 3.5	968,700	959,974	1	....	1	2	1	1	38	28	12	40	29	13	177	208	192
Colorado	12	....	8	66	....	86	101	133	—35.3	425,881	709,055	2	....	1	3	1	5	51	70	61	54	71	66	57	67	64
Florida	....	....	....	1	....	1	1	1	.....	12,219	9,488	....	....	....	....	....	....	1	1	1	1	1	1	2	2	....
Georgia	....	....	....	....	....	....	....	....	.....	.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	3
Idaho	....	....	....	1	....	1	....	....	.....	3,947	.....	....	....	....	....	....	....	1	....	....	1	....	....	1	....	....
Illinois	104	....	....	112	....	216	235	317	—31.9	506,016	747,833	2	....	....	2	....	1	56	62	69	58	62	70	277	232	250
Indiana	20	....	1	10	....	31	58	64	—51.6	44,358	106,777	....	....	....	....	1	1	10	16	15	10	17	16	110	100	84
Kansas	176	....	40	140	2	358	355	350	+ 2.3	1,325,747	1,262,650	15	....	4	19	7	14	64	72	64	83	79	78	510	553	422
Kentucky	42	....	19	56	....	117	149	170	—31.2	188,380	236,475	3	....	....	3	4	....	3	2	15	6	6	15	93	110	124
Louisiana	171	17	16	87	....	291	393	245	+18.8	2,666,558	1,961,503	3	4	....	7	12	5	44	59	30	51	71	35	412	424	372
North Louisiana	100	1	5	34	....	140	144	71	+97.2	483,803	263,203	1	1	....	2	1	....	14	13	5	16	14	5	67	69	59
South Louisiana	71	16	11	53	....	151	249	174	—13.2	2,182,755	1,698,300	2	3	....	5	11	5	30	46	25	35	57	30	345	355	313
*Gulf of Mexico	26	3	3	7	....	39	52	32	+21.9	354,553	278,117	1	....	....	1	4	1	3	3	1	4	7	2	87	89	61
Maryland	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	2
Michigan	11	....	2	22	....	35	40	54	—35.2	112,081	146,741	1	....	....	1	1	1	15	17	14	16	18	15	57	69	65
Mississippi	13	....	....	14	....	27	40	39	—30.8	198,480	289,384	3	....	....	3	1	1	11	21	17	14	22	18	29	32	37
Missouri	....	....	....	....	....	....	....	1	.....	.....	1,960	....	....	....	....	....	....	1	....	1	1	....	1	1	1	1
Montana	19	....	1	17	....	37	40	51	—27.5	191,278	237,544	....	....	....	....	1	1	10	19	19	10	20	20	31	46	35
Nebraska	24	....	....	61	....	85	47	75	+13.3	507,134	413,673	5	....	....	5	2	3	43	18	34	48	20	37	29	31	42
Nevada	....	....	....	1	....	1	....	1	.....	3,386	7,885	....	....	....	....	....	....	1	....	....	1	....	....	3	3	4
New Mexico	127	....	46	48	....	221	150	151	+46.4	976,897	728,349	3	....	1	4	3	2	27	22	16	31	25	18	152	173	147
New York	10	....	3	3	17	33	45	23	+43.5	58,300	35,800	....	....	....	....	....	....	....	....	....	....	....	....	57	68	41
North Dakota	15	....	....	11	....	26	24	21	+23.8	179,486	157,167	2	....	....	2	1	....	9	5	5	11	6	5	22	26	20
Ohio	43	....	16	16	....	75	86	98	—23.5	186,220	222,469	....	....	....	....	....	....	2	....	....	2	....	....	218	205	214
Oklahoma	373	4	27	186	19	609	503	831	—26.7	2,096,876	3,041,490	10	2	2	14	12	11	51	49	79	65	61	90	558	570	669
Pennsylvania	26	....	16	5	27	74	91	63	+17.5	189,142	179,524	....	....	2	2	1	....	2	....	....	4	1	....	162	184	121
South Dakota	....	....	....	2	....	2	1	....	.....	10,797	.....	....	....	....	....	....	....	2	1	....	2	1	....	5	6	2
Texas	1,159	32	67	767	16	2,041	1,839	1,889	+ 8.0	8,705,622	8,101,789	44	9	5	58	57	52	464	462	436	522	519	488	1,288	1,347	1,367
District 1: South Central	82	1	....	55	....	138	131	173	—20.2	387,382	422,166	4	....	....	4	3	2	40	58	52	44	61	54	50	46	47
District 2: Middle Gulf	12	7	8	40	....	67	64	89	—24.7	422,482	569,229	....	1	2	3	3	3	23	25	17	26	28	20	40	48	41
District 3: Upper Gulf	81	11	4	83	....	179	156	138	+29.7	1,250,244	901,735	5	3	1	9	4	4	48	40	33	57	44	37	140	149	133
*Gulf of Mexico	1	....	....	3	....	4	4	....	.....	31,433	.....	1	....	....	1	....	....	2	....	....	3	....	....	1	5	3
District 4: Lower Gulf-S. W.	45	10	15	56	....	126	117	107	+17.8	640,945	572,523	2	2	....	4	5	5	41	40	30	45	45	35	77	83	84
*Gulf of Mexico	1	....	....	....	....	1	2	3	—66.7	8,710	31,176	....	....	....	....	....	....	....	....	....	....	....	....	4	2	1
District 5: East Central	3	1	1	11	....	16	16	33	—51.5	96,847	110,917	1	1	....	2	....	....	11	15	19	13	15	19	10	12	10
District 6: Northeast	56	....	10	38	....	104	110	86	+20.9	555,488	446,504	....	....	....	....	1	1	20	14	27	20	15	28	71	70	57
District 7-B: North Central	158	....	3	99	1	261	261	356	—26.7	908,321	1,232,419	11	....	....	11	13	12	56	105	112	67	118	124	120	125	153
District 7-C: West Central	67	....	1	54	....	122	84	90	+35.6	533,569	415,980	4	....	1	5	8	5	38	17	24	43	25	29	99	104	113
District 8: West	301	....	5	81	....	387	430	292	+32.5	2,054,850	1,488,749	7	....	1	8	10	8	46	34	42	54	44	50	319	344	398
District 9: North	258	....	5	229	15	507	366	399	+27.1	1,330,472	1,461,244	8	....	....	8	9	7	132	106	72	140	115	79	251	258	230
District 10: Panhandle	96	2	15	21	....	134	104	126	+ 6.3	525,022	480,323	2	2	....	4	1	5	9	8	8	13	9	13	111	108	101
Utah	5	....	1	3	....	9	12	22	—59.1	52,469	102,387	1	....	....	1	....	....	2	7	16	3	7	16	38	38	15
West Virginia	6	....	33	14	....	53	63	78	—32.1	149,844	201,775	....	....	2	2	4	....	2	1	....	4	5	....	182	196	172
Wyoming	24	....	1	28	....	53	132	110	—51.8	279,924	545,541	2	....	1	3	2	2	19	34	44	22	36	46	66	86	72
Total United States	2,624	53	299	1,751	81	4,808	4,722	5,065	— 5.1	20,378,732	20,680,855	98	15	19	132	111	102	940	983	961	1,072	1,094	1,063	4,625	4,885	4,597
Total Western Canada	157	....	4	63	....	224	308	259	—13.5	1,012,681	1,227,766	....	....	....	....	....	....	....	....	....	....	....	....	196	229	211

* Gulf of Mexico wells are included in their respective district totals.



Beth-Co-Weld is widely used in waterflood projects, like this one in Texas.

BETH-CO-WELD - *a highly respected pipe for oil-country service*

Beth-Co-Weld line pipe, a product of Bethlehem Steel, is the top choice of many operators for use around the lease or rig. One of the first fully accepted types of continuous-weld pipe, it is known throughout the oil fields for its soundness and uniformity.

Bethlehem Supply stores carry Beth-Co-Weld. When in the market for line pipe, call our nearest store and check the inventory. Chances are, you can get the Beth-Co-Weld you want from stock.

Quick Facts About Beth-Co-Weld

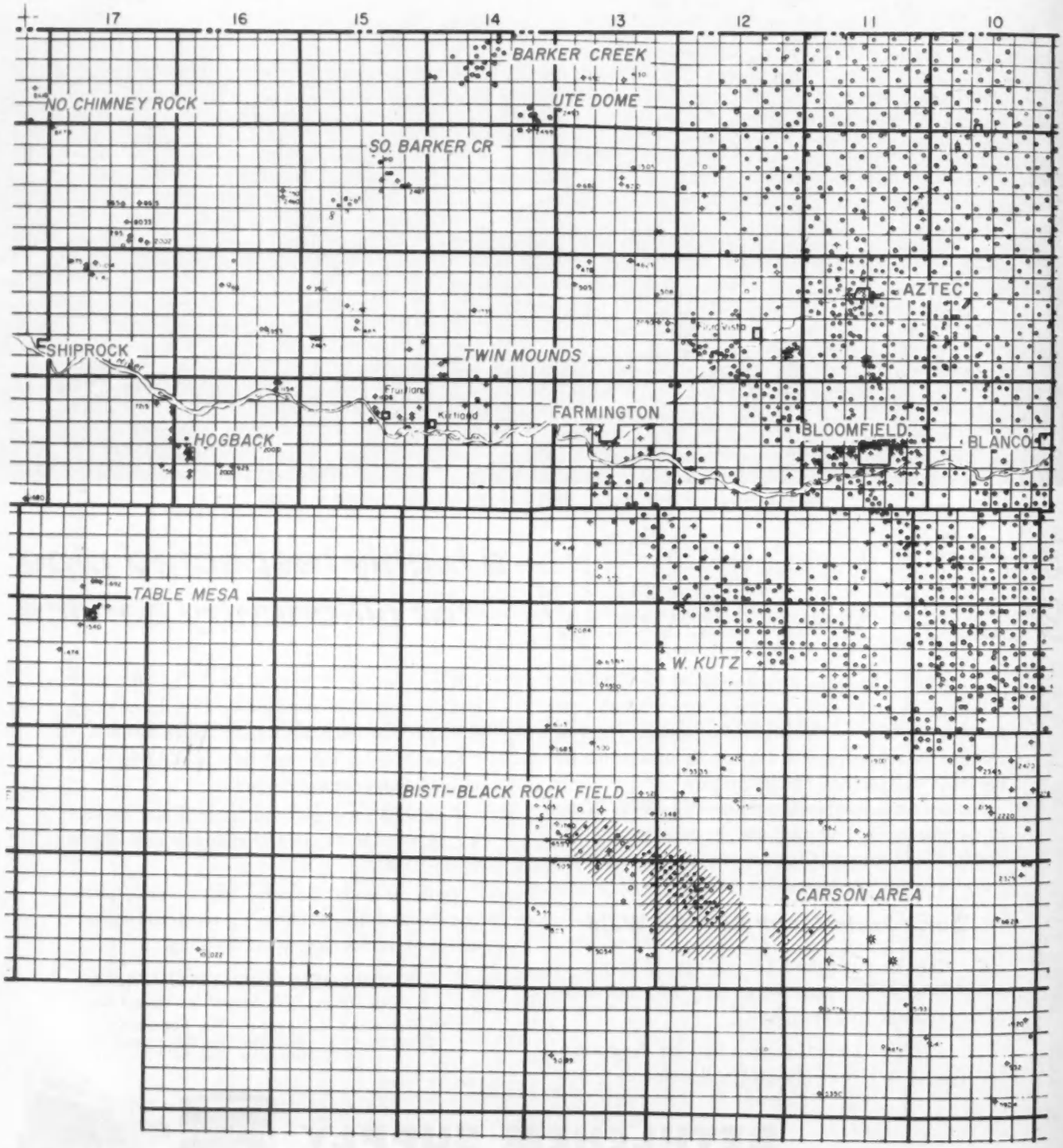
- Can be furnished to the requirements of ASTM A-120 and A-53, API 5-L, and other equivalent specifications.
- Available coated, or uncoated for field wrapping. Can also be obtained mill-wrapped.
- Sizes from ½ in. nominal to 4½ in. OD, black and galvanized, in standard weights; from ½ in. through 3 in. nominal in extra-strong weights.
- Sizes 3½ in. OD and 4½ in. OD in some weights lighter than standard.
- Furnished in single mill lengths, and in sizes 1½ in. through 4½ in. OD in double mill lengths up to 50 ft.
- Types of ends: threaded-and-coupled, plain-end-beveled for welding, or plain-end-square-cut, grooved for ring-joint coupling.

BETHLEHEM SUPPLY COMPANY
General Offices: 21 E. Second St., Tulsa, Okla.
West Coast Headquarters: Los Angeles, Calif.
Export Distributor: Bethlehem Steel Export Corporation
25 Broadway, New York, N. Y.

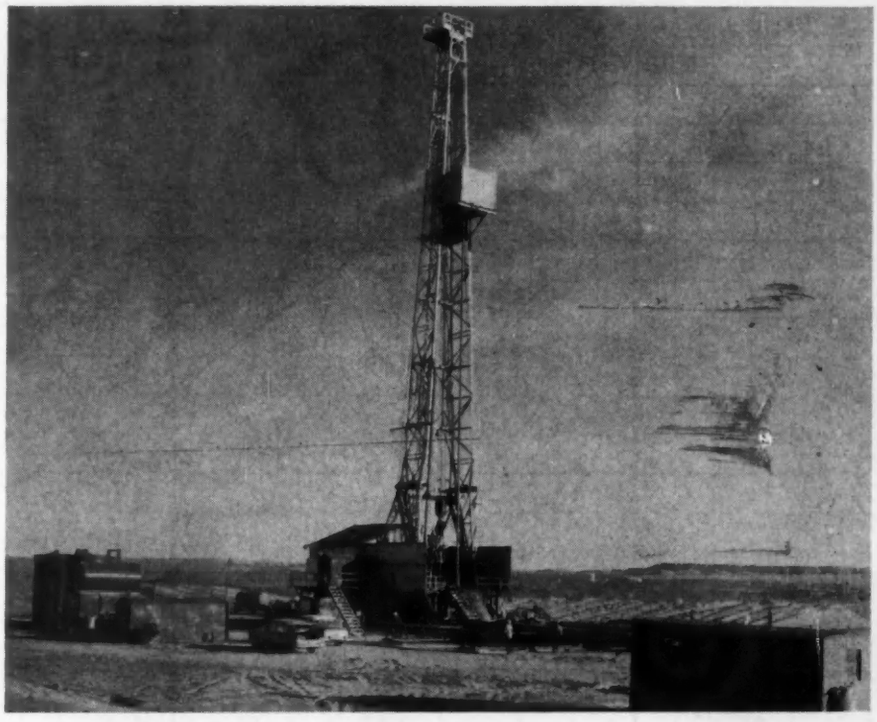
BETHLEHEM SUPPLY

Bisti-Black Rock Is Important San Juan

Much generally proven but undrilled acreage still exists between widely spaced development wells and significant stepouts at several points.



Basin Find



Typical drilling rig operating in northwest end of Bisti-Black Rock field. This is one of the locations where loose sand had to be pulled out and replaced with shale to provide stable rig base. View looking southeast. Producing wells and tanks in distance.

THE BISTI-BLACK ROCK FIELD, situated some 20 miles south-southeast of Farmington, New Mexico, on the southwest flank of the principal gas producing area of the San Juan Basin area, was discovered in 1955 with the completion by El Paso Natural Gas Company of their Kelly-State 1 wildcat flowing 180 barrels per day and 100,000 cubic feet of gas per day.

It was the first major oil production of this type for the San Juan Basin and was the first substantial production from the Gallup formation of Upper Cretaceous age. It sparked a high degree of interest in what has been primarily a gas producing area.

Surface and subsurface geology contributed to the discovery of this stratigraphic trap field. When, shortly after the discovery well was completed, a four-mile northwest extension test by another operator was completed for nearly 600 barrels per day, rapid development of the field was started. At the present time, the field has about 60 completed wells. Activity is now leveling off due to a lack of market outlets. The present roughly-outlined productive or proved area, not including the new Carson play, appears to be a northwest-southeast trending field of from 10 to 12 miles in length by as much as four to six miles wide at its widest point.

Proven acreage is difficult to assess but, assuming undrilled area between outlying completions as proven, the field may contain a possible 25,000 to 30,000 acres. This estimate would prove to be low if ground between the Carson and main areas should be productive. Spacing which started out originally on a 40-acre basis now ranges up to as high as 80 and 160 acres per well; the wider spacing reflecting a gradually reducing porosity and permeability as limits of the field are pushed outward.

Principal operators in the field include British-American, Shell, Sunray-Mid-Continent, El Paso Natural Gas, Phillips, Amerada, C. M. & W. Drilling Co., and a few independents.

Future development appears to include extensions to the south and east as well as along some parts of the existing flanks. More recently, a pair of significant discoveries (also in the Gallup Zone) has sparked a new play in the Carson area several miles east of the southeasternmost end of the main producing area. It is likely that this apparent change of direction of the trend will cause a pick-up in drilling in this area. Additional drilling also would be expected if and when outlets for crude improve. At present, approximately eight rigs are operating in the area.

Reserve estimates range from 2000 to 3000 barrels per acre. Ultimate recovery probably will hinge also on producing techniques and withdrawal rates dictated by what is believed to be a solution gas type drive.

Leasing in the area hinges on availability of Indian lands since most of the acreage is pretty well controlled. Wildcatting is continuing to some extent along the northwest end of the field.

Geology, Typical Producing Conditions. Principal formations drilled are shales and sands; the producing formation being the Gallup (Tocito) sandstone encountered at depths of from 4500 to 5000 feet.

Typical initial production rates vary from 200 to as high as 1300 barrels of oil per day and flowing on ½-inch to ¾-inch chokes. Stabilized production recently has been prorated on the basis of available outlet to about 30 barrels per day. Current daily output of the field is approximately 1500 barrels.

Crude is sweet and ranges in gravity from 36 to 39 degrees. Most wells now being completed are equipped with pumping units.

The present outlet by trucking is El Paso's Prewett, New Mexico, refinery. A pipe line outlet to Salt Lake City is under consideration.

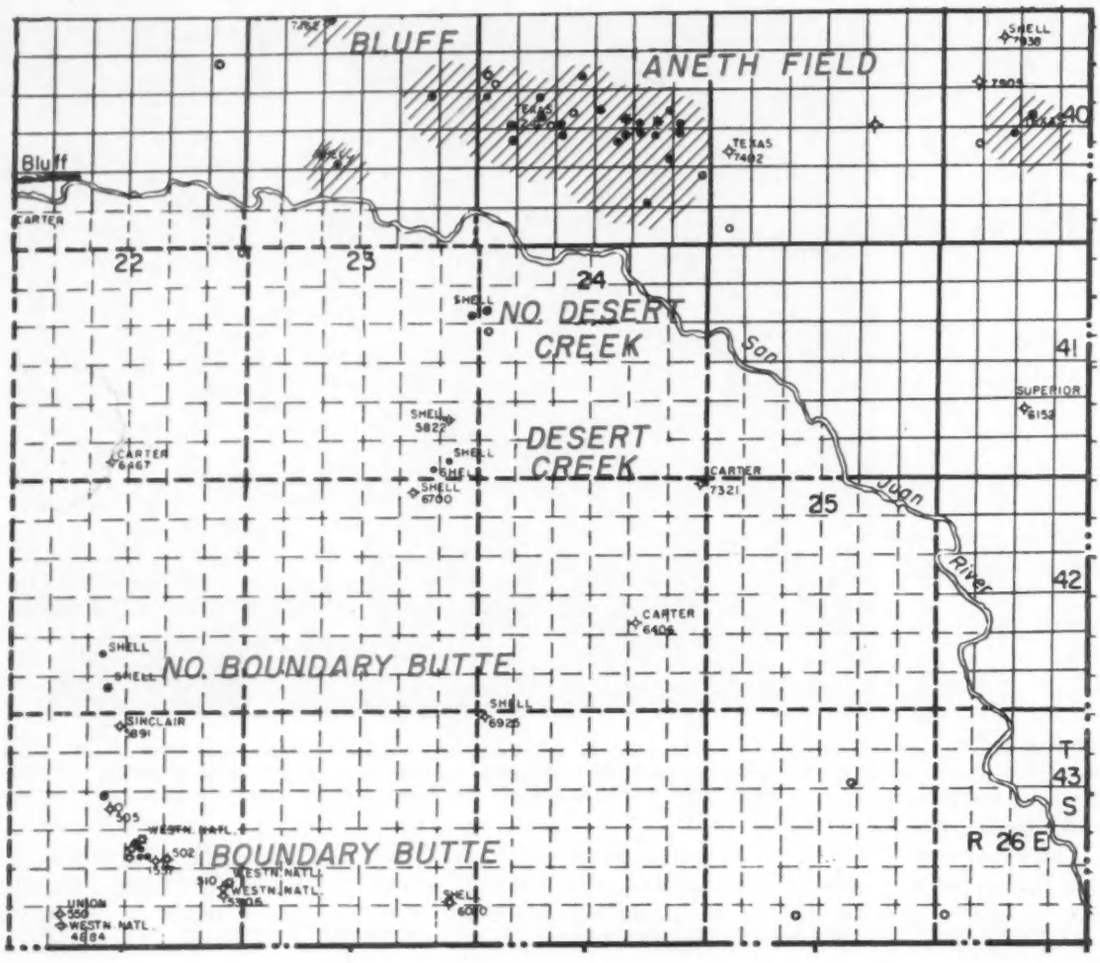
Typical Drilling, Completion Programs. Typical hole size and casing program includes drilling 12¼-inch hole to 300 feet, setting 8⅝-inch and cementing with 125 sacks, then drilling 7⅞-inch hole to total depth and running 5½-inch casing.

Drill collar program may include up to 12 six-inch collars down to 3400 feet with two more added to drill to completion.

Bit consumption averages one 12¼-inch and twelve 7⅞-inch.

Mud used is mostly natural. No

Continued on Page 93



ANETH FIELD

Aneth Significant Paradox Basin Strike

Geologists have reasonable evidence indicating that the Aneth production comes from a Pennsylvanian reef.

EVERY INDICATION points toward the Aneth area in southeast Utah as one of the most important discoveries of 1956 for the Rocky Mountain region. With some 22 wells already completed in the main part of the field and with important high-potential completions at distances of up to nine miles away, it appears certain that exploratory and development work will be at a high rate for some time to come. Located some 24 miles north northwest of the Four Corners point (where the states of Arizona, Utah, Colorado and New Mexico meet at a common point) or some 75 to 80 miles as the crow flies due west of Durango, Colo., the field was discovered by The Texas Company at their Navajo 1, completed in February, 1956, for 1704 barrels of oil per day, open tubing, of 43 gravity crude, from the interval 5828-74 feet. Surface work, plus seismic and gravity survey work, have contributed to the structural picture that still is unfolding as the productive limits are pushed farther outward.

Principal leaseholders in the immediate area are Shell Oil Company, The Texas Company and Superior Oil Company. Several independents also have been active. About 18 rigs are running in the area. The future appears favorable for high recoveries, with figures of from 10,000 to 30,000 barrels per acre being discussed. Acreage in the area is fairly well leased up except for Navajo Indian holdings which, at this writing are being offered on a bid basis for exploration. It is reasonably certain that some farmouts will be available in some of the surrounding areas. There would appear to be some prospects for deeper pays.

Within the past month or two, at least two important outlying tests have been completed which materially enlarge the apparent present outlines of the field. Shell Oil Company's Re-

capture Creek 1, some five miles west southwest of the main part of the field, flowed initially in excess of 700 barrels per day on drill stem test from the Hermosa and, at the other end of the field, some nine miles east of the eastern end of the main area, and separated by one failure, The Texas Company recently completed their Navajo 1-J for a flowing potential of 1400 barrels per day through 1-inch choke from the Upper Hermosa in the interval 5585-5625 feet. Another and more recent completion was made in the Bluff area some 3½ miles northwest of the nearest producer in the west end of the main producing area. Production in the main producing area is from the Paradox Member of the Hermosa. Other tests are underway in various parts of the area at distances ranging from 1 to 3 miles out from the main producing sector.

Geology, Typical Producing Conditions. Structure of the field is believed to be a Pennsylvanian Reef. Production is obtained from both the Paradox Member of the Hermosa and the Upper Hermosa, both of Pennsylvanian age. The Paradox is encountered at around 5500 feet, with the Upper Hermosa above this depth.

Typical initial production rates, flowing, have ranged from 250 to as much as 1800 barrels per day, with the higher rates somewhat more predominant. Gravity of the crude is 43. Crude is sweet.

Outlets for crude still are inadequate. Some oil is being trucked to Thompson, Utah, for shipment by rail to Salt Lake City. Highest hope, now, is for early start on a proposed 350-mile, 8-inch pipe line between San Juan Basin fields (principally Bisti-Black Rock and Aneth, at this stage of development) to carry crude to refineries in Salt Lake City. Construction is to start shortly and is scheduled for completion some time next fall. More recently, Texas-New Mexico Pipe Line Co. announced plans to build a 515-mile 16-inch crude line between the Four Corners area and Jal, New Mexico.

Current total production of the field averages between 2000 and 3000 barrels per day, with some wells still shut in or producing as little as 30 barrels daily.

Typical Drilling, Completion Programs. Insufficient wells have been drilled to enable drawing a pattern of drilling and completion practices but in at least a few instances noted, 12½-inch hole is drilled to 950 feet for 9⅝-inch surface casing, then 7⅞-inch hole is drilled to total depth for 5½-inch production string.

Drill collar program calls for using from 2 to 8 collars down to 900 feet, with the number increasing until as many as 18 are in the string by the time depth of about 3800 feet is reached, and as many as 21 down to total depth.

Bit consumption, still without any definite pattern from which to draw, may amount to seven 12¼-inch and 62 of 7⅞-inch size.

Some danger of blowouts, with consequent extra attention needed in mud program, in the Paradox. Some lost circulation trouble is encountered but it is not believed to be serious. Drilling rate is considered as moderate.

Typical rotary speds would range from 90 rpm in surface hole, 75 down to 6000 feet, and 50 to 60 from there to total depth.

Weight on bit will range from 32,000 to 40,000 pounds.

No unusual problems or fishing jobs have been noted.

Wells completed so far usually are cased, perforated and, in some cases acidized, and swabbed in.

Average completion time now ranges from 30 to 35 days from spudding-in to production in the tanks.

Medium size rigs, powered with diesel or LPG generally are used.

General Information. Drilling water usually is trucked in.

Nearest principal town or supply center is Durango, Colo., (Pop. 7500) some 75-80 miles due east of the field, further by road. This also would apply to machine shop and service facilities.

Road conditions are fair to poor, and accounts for one of major cost items for operators in this area. Rough terrain and complete lack of roads to outlying areas necessitate extensive road-building operations.

Living quarters for crews must be provided, with trailer courts being best solution. Few permanent dwelling available in the region. —**The End**

Bisti-Black Rock

Continued from Page 91

trouble with blowouts is encountered and there are no important circulation problems. Mud control is not critical.

Drilling rates compare with those encountered in the Denver Julesburg Basin where drilling is considered notably easy. No cementing problems are encountered.

Typical rotary speeds range from 100 down to 1500 feet; 85 to 4000 feet; 70 to total depth. Usual weight on the bit ranges from 24,000 to 36,000 pounds.

Wells in most cases are perforated, then fractured and swabbed in.

Average rigging-up time, moving off to spudding-in, is one day.

Average completion time, spudding-in to production in the tanks averages about 12 days.

Equipment Used. Medium-size jackknife type rigs are most commonly used. They are powered by diesel and in some cases, LPG, multi-cylinder engines. One mud pump is common practice. One blow-out preventer is common.

Some steel mud tanks are employed; others excavate pits and ditches.

General Information. Drilling water is a problem in the field. Some operators drill water wells; others truck it in.

Nearest principal supply center is Farmington, population 15,000. Same goes for machine shop and service facilities. Some facilities available also at Bloomfield, Blanco and Aztec.

Highways are paved between Farmington and other principal towns; also along the principal road extending southward through the gas producing area. The road to Bisti-Black Rock, however, is graded, generally rough but in fair to good condition.

Surface terrain in field is low, rolling sand hills. At a number of locations, the sand for some feet below the surface is unstable and must be pulled out and replaced with shale trucked in from nearby foothills before rig is erected.

Living conditions for crews are fair with few permanent quarters but good trailer courts available. Continued building is alleviating the situation.

Prevailing footage rates vary from $3.25 to $5.00. —**The End**

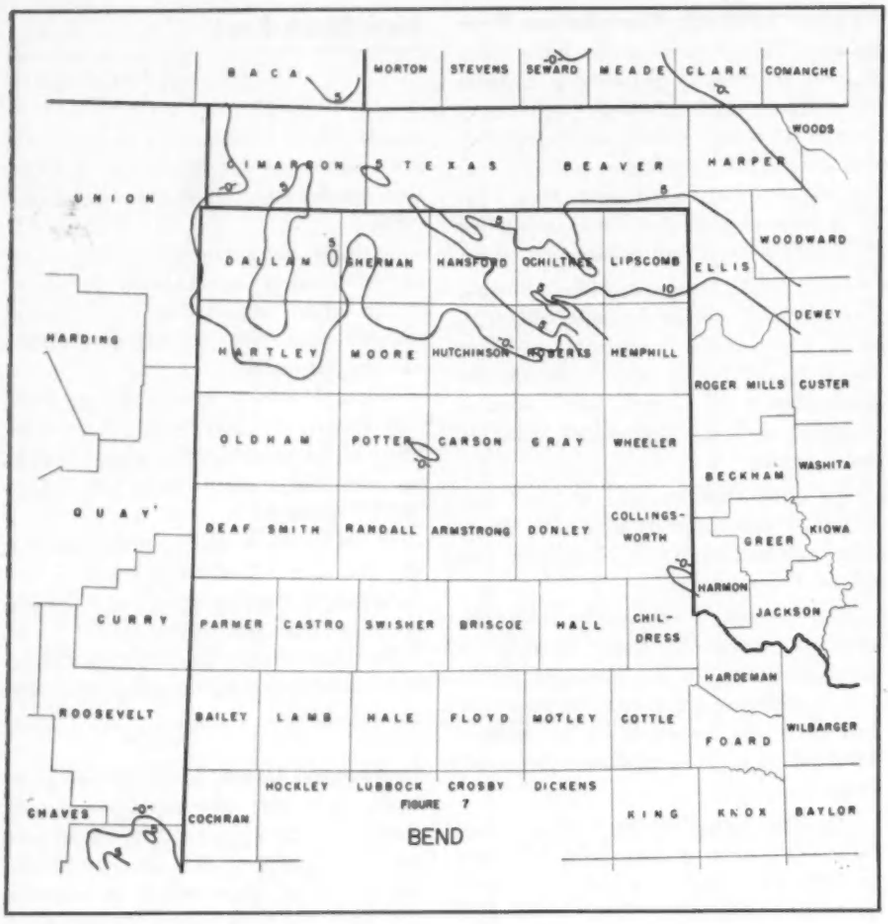
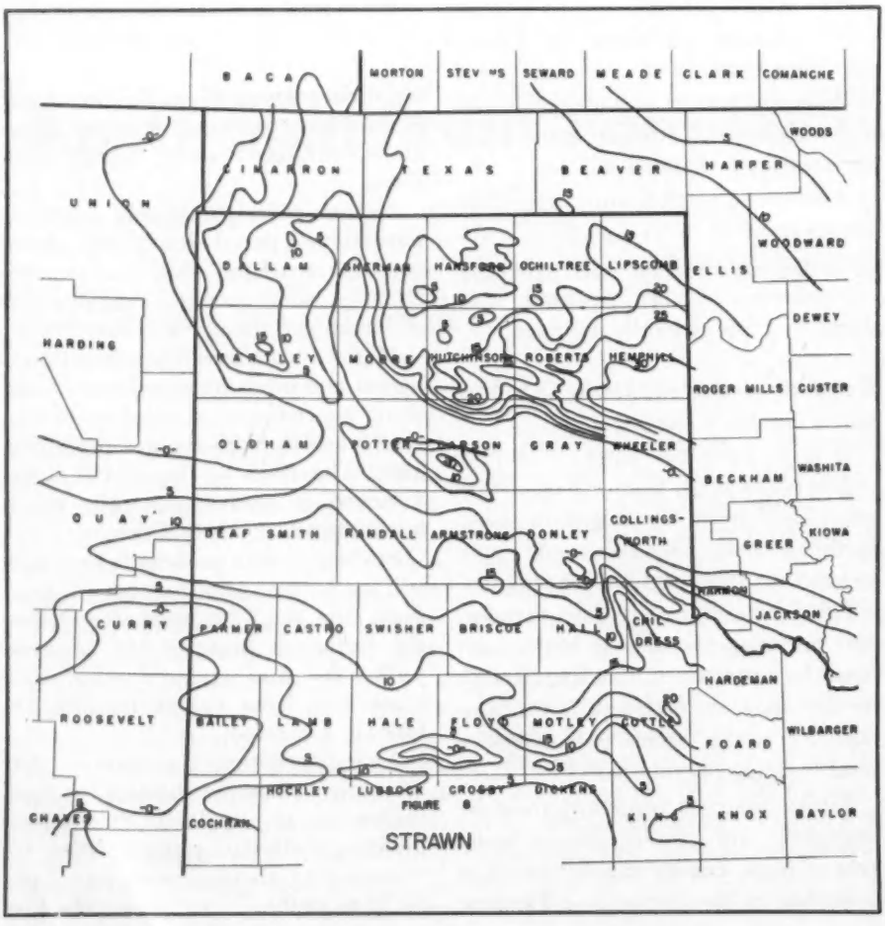


FIGURE 7—PENNSYLVANIAN BEND. Time equivalents of the Bend are in those sediments of Pennsylvanian age which are pre-Des Moines and post-Morrow in age. In Oklahoma, the Bend is represented by those sediments occurring between the base of the Bostwick conglomerate upward, to near the base of the Pumpkin Creek limestone. In Texas, by the Marble Falls group. We have not been able to identify Morrow sediments in the area. Sediments representing Bend time include coarsely crystalline, crinoidal, rather dark-gray limestone, sometimes oolitic and usually glauconitic. Some dark-gray dolomite and quartzitic sandstones with glauconite. Coarse quartz conglomerates are abundant, but feldspar is not abundant. Dark-gray, black and variegated shales represent most of the section. A basal quartz conglomerate is well developed in the northern portion of the area. It is locally called the Keyes sandstone. Local orogenies are indicated by coarse clastics. These orogenies may be recognized in the Ouachita, Arbuckle and Wichita Mountains. Lines of structural weakness were established in the area, and they play an important part in later orogencies. Age identification is based upon comparative lithologic characteristics and paleontology.

Production in Ochiltree, Hansford, Sherman, Lipscomb, and Roberts counties.



Texas

FIGURE 8—STRAWN. Time equivalent of the Strawn is in the Des Moines of Kansas and Oklahoma. Sediments representing Strawn time consist of sandstone, arkose, dark-gray to black and maroon shale, coal, anhydrite, and fossiliferous limestone. Some dolomite and bituminous shales are common in the Plainview and Anadarko basins. A basal quartz conglomerate is well developed in the northern portion of the area. It is locally called the Purdy sandstone. The major source of the clastics was from the west and northwest, the Amarillo uplift being of secondary importance. A lithologic study of Strawn conglomerates adjacent to the Amarillo uplift shows that the older conglomerates are composed of fragments of dolomite, limestone and chert. These give way with decreasing age to conglomerates composed of arkose. This condition indicates the gradual removal of pre-Strawn sediments and eventual exposure of the basement complex. Age identification is based upon paleontology and comparative lithologic characteristics.

Production in Ochiltree, Hansford, Sherman, Hartley, Hutchinson, Gray and Roberts counties.

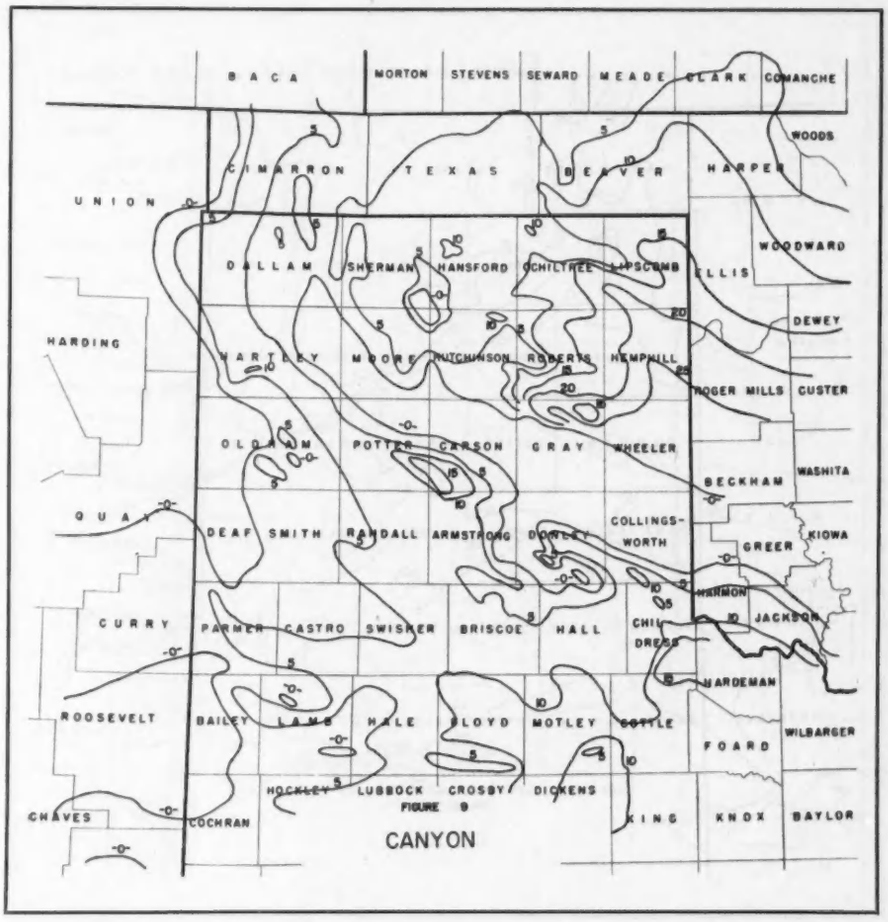


FIGURE 9—CANYON. Time equivalent of the Canyon is the Missourian of Kansas. Sediments representing Canyon time consist of fossiliferous limestone, red beds, gray and dark-gray shale, coal, coarse clastics and arkose. Bituminous shale is present in the Plainview and Anadarko basins. Thick deposits of limestone becoming "reef-like" near the margins of positive areas are common. Established orogenic weaknesses persist through Canyon time. These ended with an epeirogenic movement. Age identification is based upon paleontology.

Production in Hansford, Sherman, Floyd and Gray counties.

Panhandle Paleogeology

By **ROBERT I. ROTH,** Humble Oil & Refining Company, Wichita Falls, Texas

Part I of Dr. Roth's work subdivided the stratigraphic column into 14 time-stratigraphic Pre-Pennsylvanian units. At this point, the author explores the beginning of the Pennsylvanian since the division more nearly fits in with the producing section. Time equivalents of the Pennsylvanian Bend, the Strawn, Canyon, Cisco, Permian Wolfcamp, Leonard, Pease River, Custer, Triassic Dockum, Jurassic and the Post-Jurassic are described in detail. The absence or presence of crude in each horizon is also mentioned.

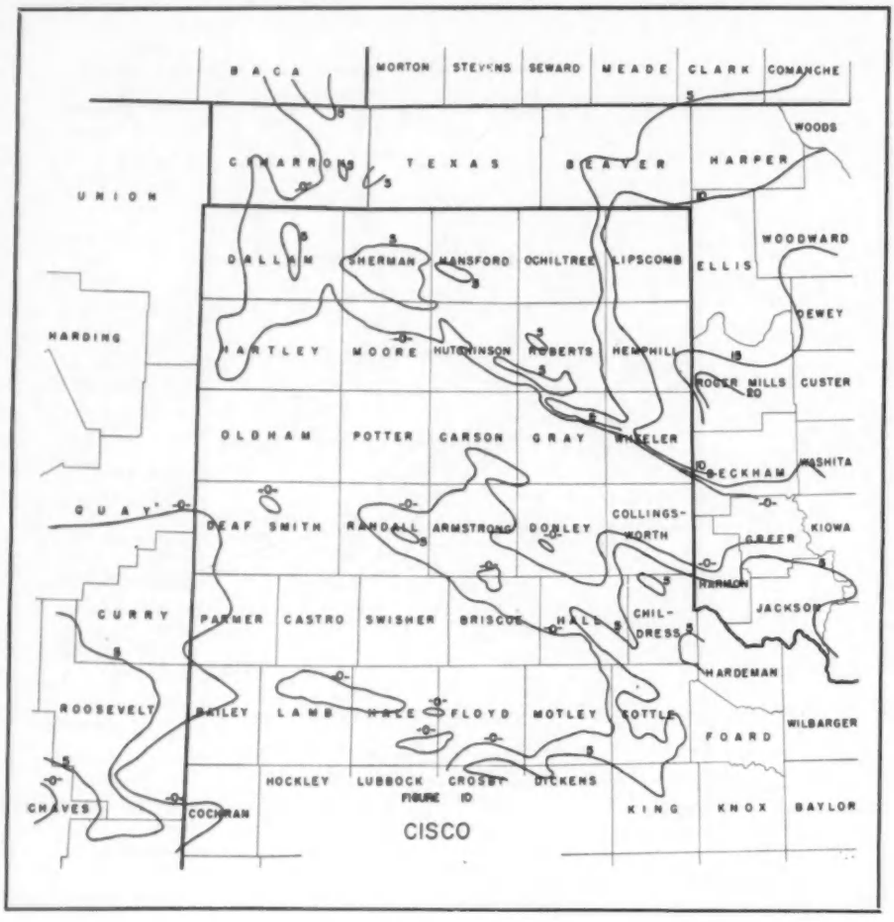


FIGURE 10—CISCO. Time equivalent of the Cisco is the Virgil of Kansas. Sediments representing Cisco time consist of red beds, gray shale, coal, coarse clastics and fossiliferous limestone. Arkose is widespread. More of it was derived from the Amarillo uplift than during earlier geologic times. Some bituminous shale is present in the Plainview and Anadarko basins. Taken as a whole, the Cisco sea was very shallow, and "reef-like" masses of limestone were built up locally. These masses of limestone are preserved today as outliers, since they resisted pre-Wolfcamp erosion. Epeirogenic movements closed the Pennsylvanian. Age identification is based unpon paleontology.

Production in Hansford, Sherman, Hemphill, Roberts, Dallam, Hale and Hutchinson counties.

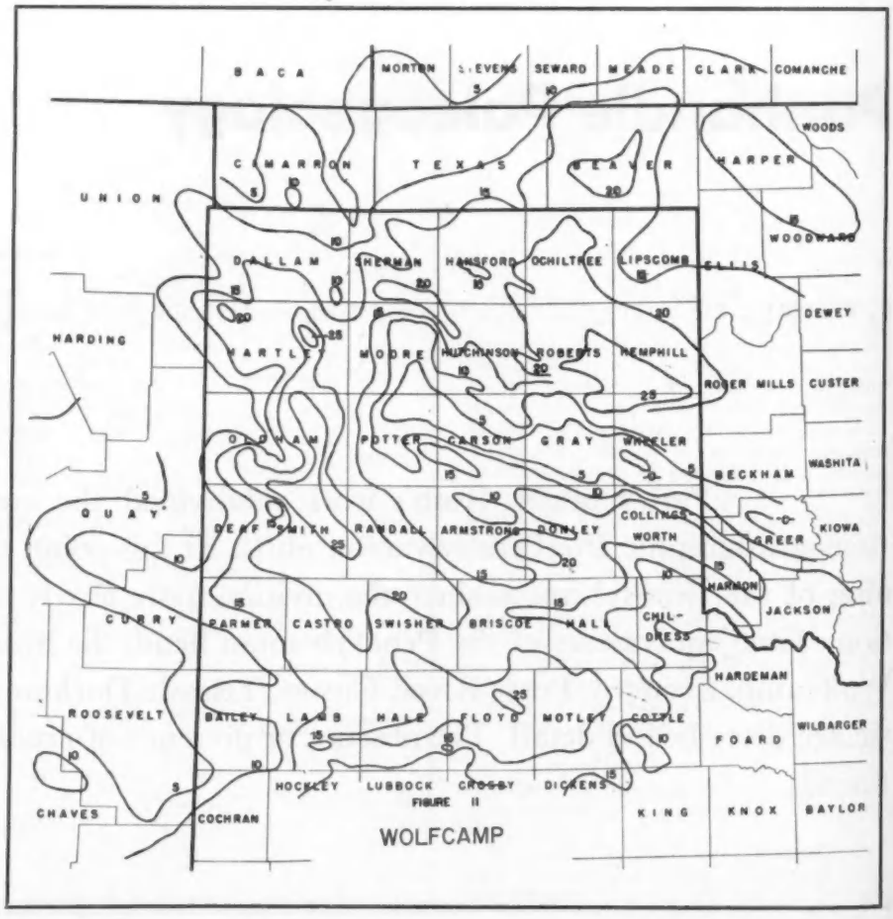
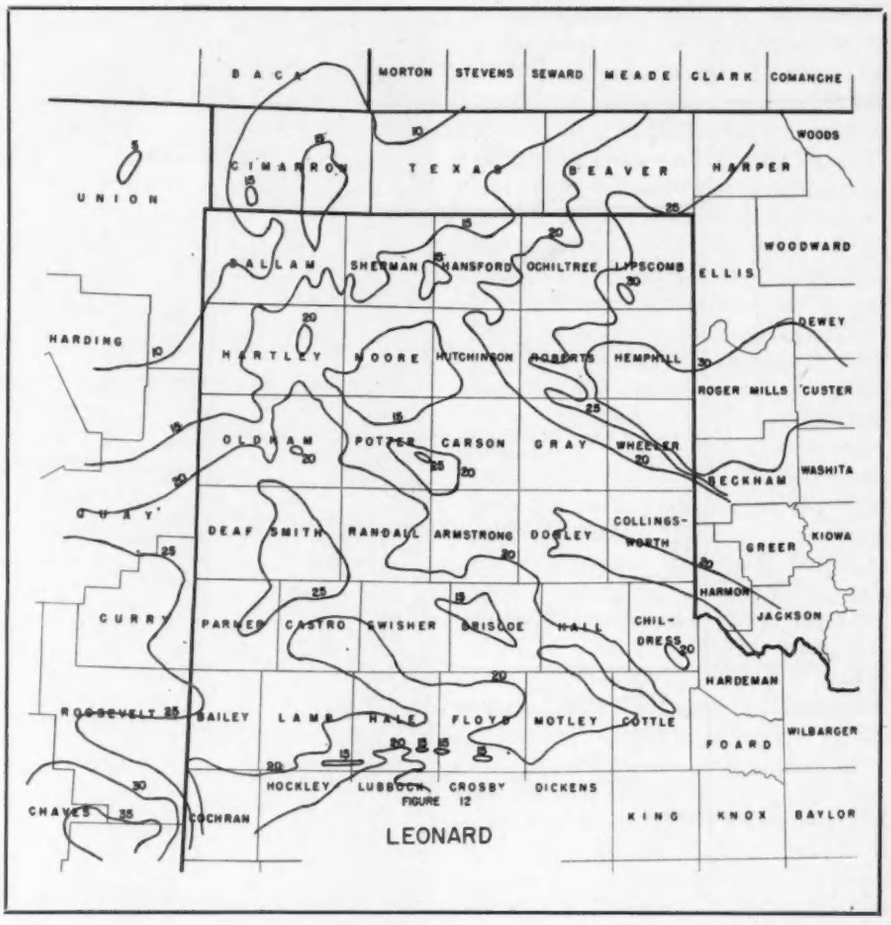


FIGURE 11—PERMIAN WOLFCAMP. Time equivalent of the Wolfcamp is to be found in the type Permian section of West Texas. Sediments representing Wolfcamp time consist of fossiliferous limestone, porous secondary dolomite, chert, chalcedony, variegated shale, and coarse clastics, most of which are arkosic. Bituminous shale is present in the Plainview and Anadarko basins. Northwest, the Wolfcamp grades into red beds and arkoses; it also thins in that direction due to erosion at the top of the section. The source of the arkose was the Amarillo uplift and the pre-Cambrian then exposed to the northwest. Tilting toward the Permian basin and epeirogenic uplift ended Wolfcamp deposition. Age identification is based upon paleontology and comparative lithologic characteristics.

The pay of the Panhandle of Texas. Anton-Irish field of Lamb-Hale counties.

FIGURE 12—LEONARD. Time equivalent of the Leonard is to be found in the type Permian section of West Texas. For correlative purposes, the Leonard may be subdivided into the Wichita at the base and the Clear Fork at the top. Sediments representing Wichita time consist of some red beds, evaporites, primary and secondary dolomite locally oolitic, and some fossiliferous limestone. The Wichita appears to be absent in the northwest corner of the area due to non-deposition. There were no local positive areas contributing sediments to the Wichita seas. Sediments representing Clear Fork time consist of red beds, evaporites, primary and secondary dolomites. The dolomites are very oolitic, especially in the upper part of the Clear Fork. The Tubb zone represents the only deposition of coarse clastics in the Plainview basin. The Leonard is the only Permian series covering the entire area. In general, it is more marine in the Plainview basin. Regional tilting to the south followed by epeirogenic uplift marked the end of Leonard time. Age identification is based upon comparative lithologic characteristics and paleontological evidence.

No production.



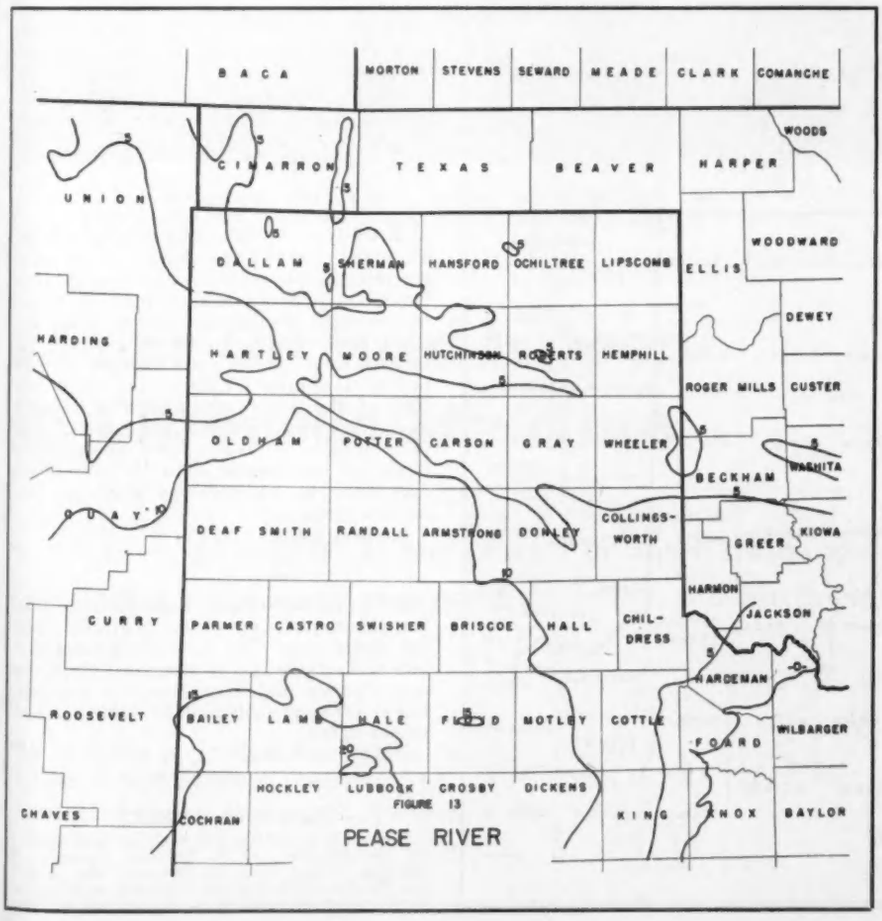


FIGURE 13—PEASE RIVER. Time equivalent of the Pease River are to be found in the Word of West Texas. Sediments representing Pease River time consist of rhythmic evaporites, red and greenish-gray shale, primary and secondary dolomites, some are oolitic, and limestone usually oolitic. There is some volcanic ash. Coarse clastics are present at the base. The basal sandstone is usually less than 100 feet thick. Its sand grains are fine and angular; there are few large frosted sand grains. In the northwestern part of the area this basal sandstone thickens to nearly 400 feet. Its sand grains become coarse, rounded, polished and when not leached, have a bright-orange color. Regional southwestward tilting followed by epeirogeny ended Pease River deposition. Age identification in the subsurface is by comparative lithologic characteristics and, where the formation crops out, by vertebrate and invertebrate paleontology.

Slaughter pay in Lamb County.

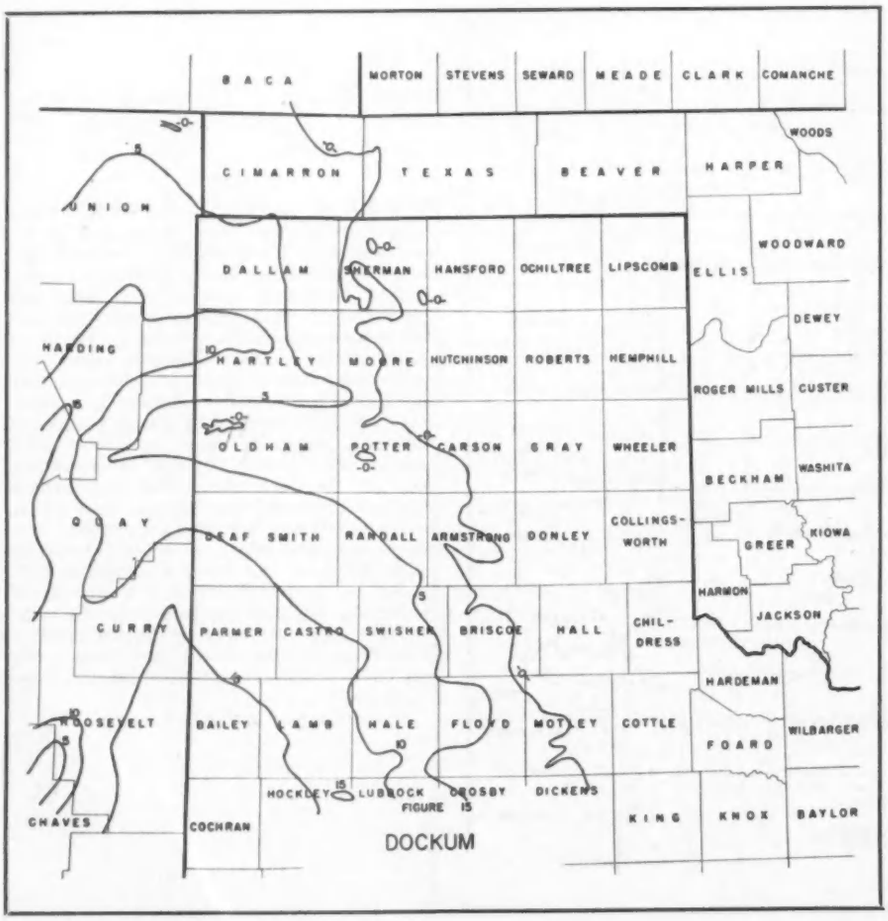


FIGURE 14—CUSTER. Time equivalent of the Custer may be found in the Bell Canyon of West Texas at its base, and Alibates to Quartermaster of Ochoa age at its top. Sediments representing Custer time consist of evaporites including magnesium and potassium salts, terra-cotta shale, primary and secondary dolomites, volcanic ash, some chert and coarse clastics. These coarse clastics include fine, orange, polished sand grains with zones of large white or sometimes orange-red sand grains. Petrographic analyses of the Elk City, which is a coarse bright orange-red sandstone, indicates that it was derived in part from pegmatitic granites. Regional tilting southwestward occurred during Custer time. Age identification in the subsurface is based upon comparative lithologic characteristics and, where the formation crops out, by invertebrate paleontology.

No production.

FIGURE 15—TRIASSIC DOCKUM. Time equivalent of the Dockum may be found in the Kuper or Upper Triassic in the eastern and western portions of the United States. Sediments representing Dockum time consist of variegated shale and coarse clastics with some volcanic ash as cementing material. The conglomerates, "clay ball," present in the northern part of the area were derived from older sediments. In the southern part of the area, the conglomerates were derived from a Precambrian metamorphic complex exposed to the south. Marine Upper Triassic fossils have not been found. Regional southwestward tilting followed by epeirogenic movements ended Dockum deposition. Age identification in the subsurface is based upon comparative lithologic characteristics and, where formations crop out, by vertebrate paleontology and paleobotany.

No production.

JURASSIC—SUNDANCE-MORRISON. Since sediments of the above age are present only in the northwest portion of Dallam County, no figure showing its thickness is presented. Sediments representing Jurassic time consist of light gray-green and maroon shales with coarse clastics. A thick bed of sandstone "Exeter" occurs at the base of the series and much of its sand grains are well-rounded and frosted. Age identification is based upon comparative lithologic characteristics in the subsurface and vertebrate paleontology where the formation crops out.

No production.

POST-JURASSIC. Sediments of Comanchean age are widely scattered over the entire area. The "Cap rock" or Ogallala of Tertiary age, is composed of caliche and clastics and is extensively exposed. Large areas are covered by blow sand of recent age.

No production.

ACKNOWLEDGMENT

Permission to publish this work has been granted by the Humble Oil & Refining Company of Houston, Texas. John W. Skinner, who is with the Humble Oil & Refining Company, aided in the identification of fusulinids found in well cuttings.

Trans-Tex Drilling Company's Boy Scouts 1, discovery well in the South Citronelle field, Mobile County, Ala. Well flowed 497 barrels of oil per day from a depth of 10,980 feet.

Major Oil Field Is Seen In Citronelle Structure

Citronelle is one of two or three dozen geophysical anomalies in southwest Alabama and northwest Florida.

By **WALTER B. JONES,** State Geologist, and
WINNIE McGLAMERY, Paleontologist,
Geological Survey of Alabama, University, Ala.

CULMINATING YEARS of interest in a prominent structure at Citronelle, in north-central Mobile County, Alabama, the Donovan 1 ushered in one of the most important discoveries of 1955. The date was August 16, 1955, when the drillstem test assured commercial production. Several dry holes had been drilled in the area, all too shallow. The Means B. Odum 1 of Smith County Oil Company in the SE quarter of the SE quarter of Sect. 24, T2N, R3W was drilled to 7536 feet and abandoned on July 26, 1950. That would have been the discovery well for the field had it gone deep enough. Gulf Refining Company received a permit on August 30, 1956, to deepen the well and it is now producing. Another was E. B. Sullivan's Q. U. Thompson 1 in the SE quarter of the NE quarter of Sect. 31, T2N, R2W, drilled to 9008 feet and abandoned January 31, 1948. It is on the eastern flank and may be outside the productive area. Other wells were still farther out, to the east and west of the structure. One of them, the Mobile School Board 1, NE quarter of the SE quarter of Sect. 16, T1N, R3W, was drilled from its original depth of 9100 feet (1948) to 12,052 feet. It is very definitely off structure, and was abandoned November 27, 1955.

The Donovan 1 was a joint venture of Zach Brooks Drilling Company, Everett Eaves (who made the location) and Gulf Refining Company, with dry hole money from several other companies and individuals.

Geology. The Citronelle structure (see map) is an elongated dome with northwest-southeast trend. It is on the axis of the Bolton and Soso fields in Mississippi, to the northwest, both of which have Lower Cretaceous production. Actually it was that fact that led to the drilling of the Donovan 1 well, thus providing the first evidence of the Rodessa and Bailey sands of Lower Cretaceous age in Alabama. Prior production in the state had been from Upper Cretaceous beds. In one half a dozen wells deep enough to penetrate the Lower Cretaceous zones a considerable variation had been noted, so that the presence of the Rodessa beds should not have surprised any one. There has not been too much variation in the formations from Pleistocene to and including the Lower Tuscaloosa, of Upper Cretaceous age. Older

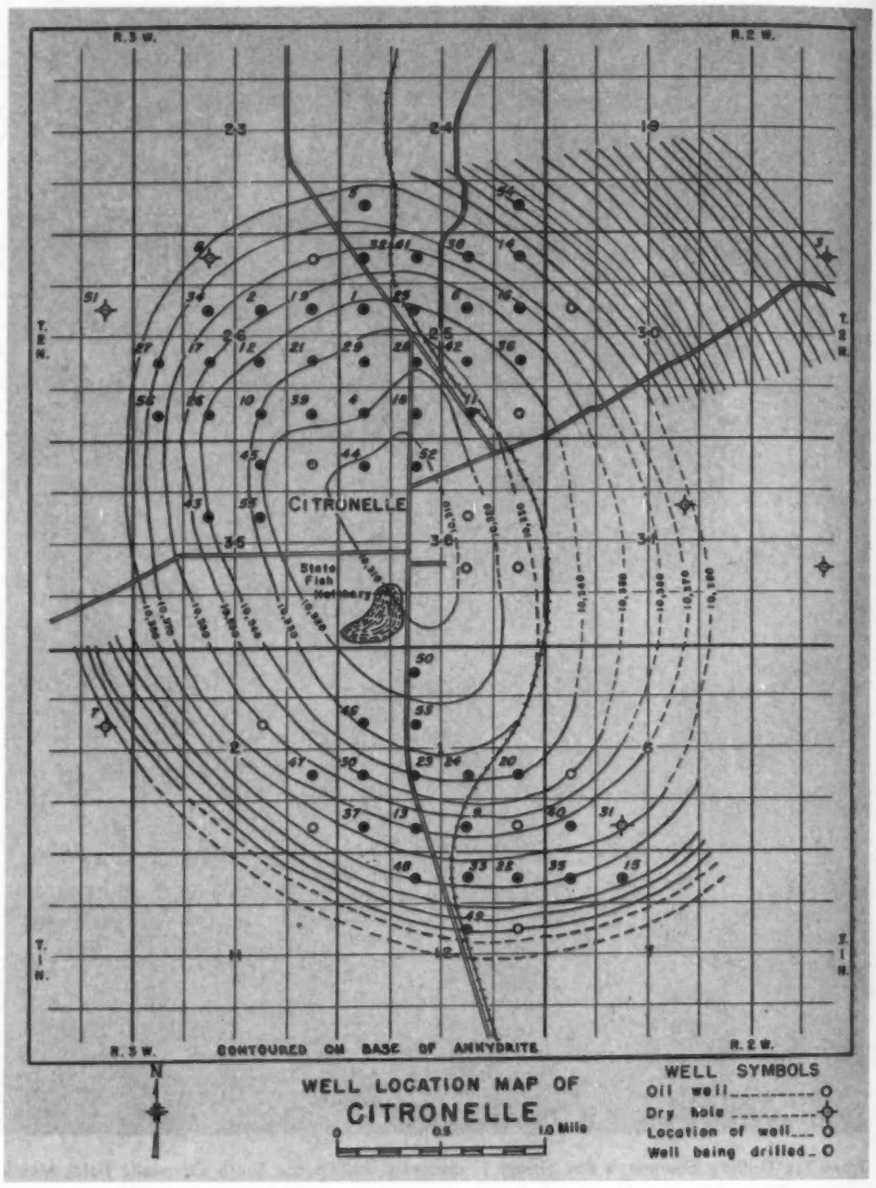
formations are not so uniform. Heretofore, geophysical work was directed toward markers in the Upper Cretaceous, which is undoubtedly unconformable to a greater or lesser extent, upon the older beds. Before the subsurface geology of southwest Alabama can be determined, geophysical studies must include markers in the deeper beds, along with deeper drilling.

Citronelle is one of two or three dozen geophysical anomalies in southwest Alabama and northwest Florida. That at Bay Minette, in Baldwin County, appears to be a large and prominent dome, probably formed by differential settling of unconsolidated beds upon a deep-seated land mass far below. It has not been tested to a depth of more than 5000 feet. That seems to be a good spot for a deep test. It is on the Bolton-Citronelle trend.

During the original subsidence of the Gulf Embayment, the surface must have been quite irregular. Early deposition must have been irregular too. Still it is in such areas that much of our oil has been found. Unfortunately wells will be costly, and more hazardous than usual. It is likely that the "easy" oil has already been found. Once the pattern is worked out, it should be much easier.

Of perhaps much greater interest is the answer to the question as to whether or not the Jurassic (Smackover) beds are to be found in the area. They certainly should be there, but probably are not continuous over the whole region. In any event, the problem of extent of the Lower Cretaceous and possibility of deeper beds must receive a lot of attention.

Also of prime interest is the indicated extension of the structure into southern Washington County to the northward, and southward deeper into Mobile County, with saddles separating the main anticline from the extensions.



Stratigraphy. The first limestone encountered in wells in the Citronelle field area is Miocene in age and occurs at approximately 700 feet. Limestones of Oligocene, Jackson, Lisbon and Tallahatta are penetrated next, and greenish claystone in the Tallahatta.

The Wilcox is entered at 1800 or 1900 feet approximately and consists of sand, carbonaceous shales, hard marl beds, with the Salt Mountain represented by gray hard limestone.

The Midway has beds of gray to black shale and soft marl beds, the black shale being in the lower portion with occasional brown claystone ledges. The Clayton is light gray soft marl.

The Cretaceous chalk is entered between 4500 and 4600 feet, at the base is 100 feet or so of dark gray speckled shale, sparingly fossiliferous.

The Eutaw is a fine-grained glauconitic sandstone interbedded with dark gray shale and is encountered at approximately 5700 to 5800 feet.

The Tuscaloosa is recognized by dark red, green, and gray clay and siderite concretions. The top in wells in this area occurs at approximately 5900 to 6000 feet. There is a dark gray and speckled shale section, slightly fossiliferous, with a glauconitic sandstone bed at the top that occurs 800 to 900 feet below the top of the Tuscaloosa. Below the shale is the Lower Tuscaloosa glauconitic sandstone and is found in the wells approximately between 6800 and 6900 feet. This is a medium-grained very glauconitic sandstone with sandy shale.

The top of the Lower Cretaceous occurs at approximately 7500 feet throughout the Citronelle field and is recognized by the pink and gray nodular lime interbedded with dark red clay and shale. The Lower Cretaceous continues with red beds and gray and pink to red sandstone.

The gray dense lime encountered at about 10,490 feet in the Donovan is Mooringsport. The Ferry Lake oolitic limestone and anhydrite occur

TABLE 1

WELL	Operator	Completed	Zones
1. Donovan 1	Zach Brooks Drilling Co.	9- 2-55	Both
2. Smithers 1	Zach Brooks Drilling Co.	11-22-55	Upper
3. Stella Lambert 1	Trans-Tex Drilling Co.—R. M. Moon	12- 7-55	Dry
4. Citronelle 1, Unit No. 1	Gulf Refining Co.	12- 9-55	Both
5. Citronelle 1, Unit No. 3	Gulf Refining Co.	1- 5-56	Both
6. Citronelle 1, Unit No. 4	Gulf Refining Co.	1- 8-56	Upper
7. Harry K. Byrd 1	Allen Guiberson	1-24-56	Dry
8. Smither 2	Zach Brooks Drilling Co. et al.	2- 8-56	Dry
9. Boy Scouts of America 1	Trans-Tex Drilling Co.	2-18-56	Upper
10. Fletcher 1	Zach Brooks Drilling Co. et al.	2-29-56	Upper
11. Citronelle 1, Unit No. 6	Gulf Refining Co.	3- 3-56	Both
12. Fletcher 2	Zach Brooks Drilling Co. et al.	4- 6-56	Upper
13. D. R. Coley Jr. et al 1	Zach Brooks Drilling Co. et al.	4- 7-56	Both
14. Opie Earle et al 1	Gulf Refining Co.	4- 9-56	Upper
15. Bertha M. Collins 1	Trans-Tex Drilling Co.	4-10-56	Upper
16. Gulf Refining Co. et al, 1, Citronelle Unit No. 12	Gulf Refining Co.	4-19-56	Upper
17. Birdie Y. Walker Unit 1	General American Oil Co. of Texas-Guiberson-Beatty	4-24-56	Upper
18. E. M. Collins Estate 1	Gulf Refining Co. (formerly George D. Hunt)	5- 6-56	Both
19. Smithers 3	Zach Brooks Drilling Co. et al.	5- 9-56	Upper
20. W. E. Carroll 1	Trans-Tex Drilling Co.	5-12-56	Upper
21. Unit 1	Zach Brooks Drilling Co. et al.	5-13-56	Upper
22. M. L. Moorer 1	Magnolia Petroleum Co.	5-20-56	Upper
23. Joy Unit 1	Zach Brooks Drilling Co. & Central Oil Co. et al.	5-25-56	Upper
24. Joy Unit 1	Central Oil Co. & Trans-Tex Drilling Co.	6- 3-56	Upper
25. Citronelle 1, Unit No. 10	Gulf Refining Co.	6- 4-56	Both
26. Graybill-Case-Young 1	Zach Brooks Drilling Co. et al.	6-18-56	Upper
27. Birdie Y. Walker 1	General American Oil Co. of Texas-Guiberson-Beatty	6-20-56	Upper
28. Citronlee 1, Unit No. 2	Gulf Refining Co.	6-21-56	Both
29. Gulf Refining Co. et al 1, Citronelle Unit No. 9	Gulf Refining Co.	6-23-56	Both
30. Joy Unit 2	Zach Brooks Dirlling Co. & Central Oil Co. et al.	6-29-56	Upper
31. Coggins-Altmayer 1	Zach Brooks Drilling Co. et al.	6-29-56	Dry
32. Citronelle 1, Unit No. 11	Gulf Refining Co.	7- 1-56	Both
33. Brown 1, Unit No. 1	Trans-Tex Drilling Co.	7- 3-56	Upper
34. Smithers 4	Zach Brooks Drilling Co. et al.	7-21-56	Upper
35. Mildred H. Hagen et al 1	Gulf Refining Co.	7-31-56	Upper
36. Citronelle 1, Unit No. 7	Gulf Refining Co.	8- 1-56	Both
37. D. R. Coley, Jr et al 2	Zach Brooks Drilling Co. et al.	8- 2-56	Upper
38. Opie Earle et al 2	Gulf Refining Co.	8- 3-56	Upper
39. Unit 2	Zach Brooks Drilling Co. et al.	8-10-56	Upper
40. Coggins-Altmayer 2	Zach Brooks Drilling Co.	8-28-56	Both
41. O. L. Earle 1	Central Oil Co.	8-29-56	Upper
42. Citronelle 1, Unit No. 14	Gulf Refining Co.	8-31-56	Both
43. Stagg 1, Unit No. 1	General American Oil Co. of Texas-Guiberson-Beatty	9- 6-56	Upper
44. Citronelle 1, Unit No. 22	Gulf Refining Co.	9-14-56	Both
45. Citronelle 1, Unit No. 29	Gulf Refining Co.	9-17-56	Both
46. Unit 3	Zach Brooks Drilling Co. et al.	9-19-56	Upper
47. Helen S. Cotting et al 1	Gulf Refining Co.	9-29-56	Both
48. Citronelle 1, Unit No. 18	Gulf Refining Co.	9-30-56	Upper
49. B. L. Onderdonk 1	Zach Brooks Drilling Co. et al.	10- 3-56	Upper
50. J. W. Turner 1	Zach Brooks Drilling Co. et al.	10-25-56	Upper
51. Stallworth Naval Stores 1	Gulf Refining Co.	11-14-56	Dry
52. Citronelle 1, Unit No. 23	Gulf Refining Co.	11-21-56	Both
53. Citronelle 1, Unit No. 28	Gulf Refining Co.	11-28-56	Upper
54. Citronelle 1, Unit No. 16	Gulf Refining Co.	11-28-56	Upper
55. Robbie M. McLeod et al 1, Unit No. 1	Jett Drilling Co., Inc. & Southern States Oil et al.	12- 5-56	Upper
56. Birdie Y. Walker 2	General American Oil Co. of Texas-Guiberson-Beatty	12- 5-56	Upper
57. Citronelle 1, Unit No. 20	Gulf Refining Co.	12- 6-56	Testing
58. Unit 4	Zach Brooks Drilling Co. et al.	12- 9-56	Both

in this well between 10,550 and 10,650 feet. The base of the Anhydrite is the top of the Rodessa.

Production in this well is from sands in the upper zone in beds between 10,870 feet and 10,960 feet. Production in the lower zone is from sands between 11,275 feet and 11,414 feet. Interbedded with the sands in the Rodessa are red and gray shales, some very micaceous.

Porosity and permeability are mostly relatively low, and variable. It is believed that the sand sections are interconnected, and thus the shale breaks are limited horizontally. Production records bear this out.

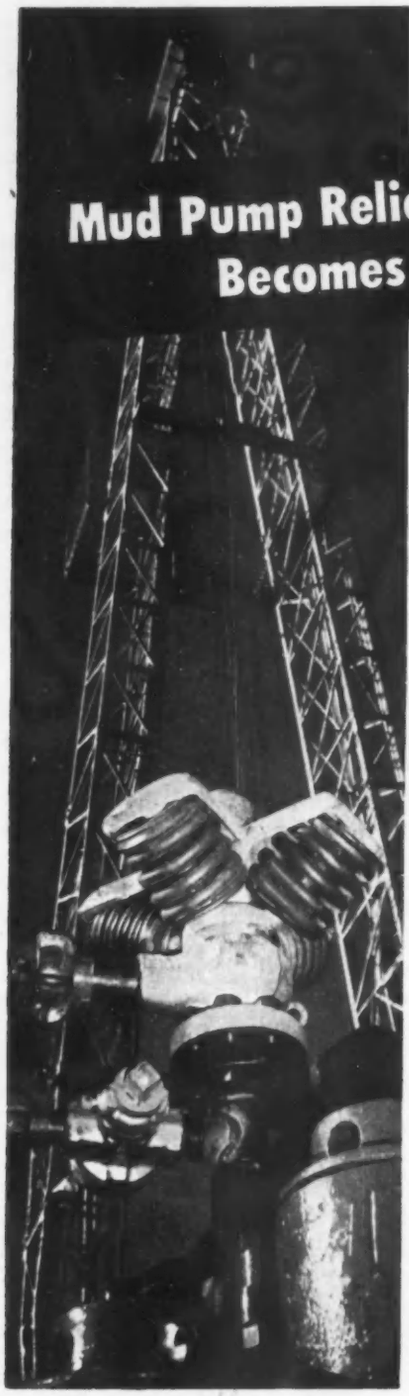
Producing Horizons. In the discovery well oil shows were reported at 7512 feet and 10,581 feet. A strong gas show was encountered at 10,618 to 10,628 feet; with some oil near the bottom of the section. Other shows were found at 10,644-10,650 feet, 10,734-10,746 feet, and 10,854-10,869 feet. The main upper sand (Rodessa) was topped at 10,874 feet, a 14-foot section, which was set up for the drillstem test previously mentioned. Water cushion was 3070 feet. The tool was open for about 5 of the 8 minutes test. Since there were "no bubbles in the bucket" it was thought that the test was a failure. When the pipe was pulled, the absorbed gas overcame the weight of the reduced water cushion, and oil sprayed all over the place. The lower sand (Bailey) was topped at 11,384 feet, and about 34 feet of sand in that formation was considered satisfactory for production. Some 175 feet of oil sand was cut in the well, and about 75 feet of it actually perforated. Results of a drillstem test in Boy Scouts 1 well were similar to Donovan 1 (see photograph, Page 99.)

The well was dually completed using two strings of 2-inch tubing, both now on pump although the upper zone flowed for nearly a year. Initial tests using ¼ inch choke ranged from 480 to 540 barrels per day for the upper zone and 80 to 130 barrels per day for the lower. Gas-oil ratio for the upper sand was 141 to 1 and 50 to 1 for the lower. Gravity was 45.9° for the upper and 41.8° for the lower. So far, water has not shown up in any well, although off-structure wells had an abundance of salt water at the production level. The writers believe that the field has water drive and that water will show up in due time. There were two water zones between the upper and lower sands, and separated from them by thick shale beds.

Of the 18 dually completed wells, 6 produce better in the upper zone, 7 in the lower zone, and 5 about equal amounts from each. Trans-Tex Drilling Company did not take its five wells in the southern part of the field below the upper sand, so the lower sand is a mystery in that group. However, an offset to the west of TransTex's Boy Scouts 1 is dually completed and the lower zone is producing the full allowable. Except for the 17 wells listed above and the TransTex group, the rest of the wells failed to produce enough in the lower zone for dual completions.

Spacing in the field is 40 acres. Field rules have been set up and approved, although the allowables are still under study. The first trial was 200 and 105 barrels per day for the upper and lower horizons respectively. Later that was changed to 300 and 200, which proved to be too high. At present the figures are 200 and 150. The Oil and Gas Board is seeking the maximum production with minimum damage to the reservoirs. The final answer is still in the future. Spacing in the field, below present producing depths, can be extended up to 160 acres under present law. Under present policy of the Board, increased spacing will be granted when the need is proved. Requests for larger units prior to drilling have been denied.

To date, there are 53 producers and 5 dry holes (see map). Certainly two of the latter are off the edge of the structure although efforts were



Mud Pump Relief Valve Importance Becomes More Critical

As mud pumps are necessarily operated at near capacity to meet the constantly increasing demands on drilling circulating systems, the safety demands on the relief valve become greater.

Responsibility for reducing hazards of personal injury, equipment damage and drilling trouble by relief of excessive drilling mud pressures, calls for a valve that assures positive instantaneous pressure relief at maximum volume and automatic restoration of circulation upon correction of the overloading condition. These requirements have been accomplished in the Kinzbach Model 112 Pressure Relief Valve by combining two unique methods of restraining the valve piston, yielding a characteristic action from a decreasing force against the valve piston on opening movement, and conversely, an increasing force during closure. This assures higher effective lift during valve action.

When excessive circulating pressures occur, the valve either repeats its cycle of rapid opening and closing, or remains open until the obstruction is removed or the pump stopped. Momentary blocks do not require pump shutdown to reset the valve. Movement of fluid may not be materially affected, preventing danger of stuck drill pipe as might occur with arrested circulation. Compounding Heads are available where pumps are used in series.

Kinzbach Model 112 Pressure Relief Valves are available in 2" and 3" sizes with pressures ranging from 500 psi to 16,500 psi. Write for complete data or consult your new Composite Catalog. Sold through Supply Stores everywhere.

KINZBACH TOOL CO INC

KINZBACH TOOL COMPANY, INC.

P. O. BOX 277 • HOUSTON, TEXAS

EXPORT OFFICE: 74 TRINITY PLACE, NEW YORK, N. Y.

made to bring in the Harry K. Byrd 1 on the western side. Two wells to the northwest (the Smithers 2 and Stallworth Naval Stores 1) may have been "pinchouts." The same may be true of the Coggins-Altmayer 1 on the southeast. It is significant that, even though the sands vary in thickness, porosity and permeability, no dry holes have been drilled within the field area.

The wells are listed in Table 1 (see map).

Production. See Table 2.

TABLE 2
Production for Citronelle Field

MONTH	Barrels of Oil	Number of Producers
Oct. 1955	11,289.00*	1
Nov. 1955	12,158.00	1
Dec. 1955	11,194.00	1
Jan. 1956	29,357.00	4
Feb. 1956	32,881.00	5
Mar. 1956	57,535.38	7
Apr. 1956	83,256.53	14
May 1956	117,747.05	18
June 1956	150,065.17	23
July 1956	195,221.53	31
Aug. 1956	225,950.32	34
Sept. 1956	199,620.76	38
Oct. 1956	229,504.08	45
Total	1,355,774.82	

* This figure was computed on a 53-day period, September 8 through October 31.

Gulf Refining Company is taking the entire production, transporting it by pipe line to Mobile. The crude is bringing about $3 per barrel.

Future. At present the main effort of the operators is the drilling of offset wells. That is progressing satisfactorily as is evidenced by 54 completions so far this year and a total of 58 since discovery. There are 16 wells drilling or locations, or a total of 74. Some 50 wells will be required to fill in the space between the northern and southern groups. How much farther out the pay sands will extend is yet to be determined. The authors believe the ultimate number of producers in Rodessa sands will be between 125 and 160, not counting the possible extensions mentioned elsewhere in this article. Also there are distinct possibilities of deeper production. It seems unlikely that deep tests will be made until the offset program is under control.

By any system of reckoning it seems certain that Citronelle will be a major oil field. —**The End**

We Have a Mast to Meet Your Needs—whether it be deep work-over or drilling from 5,000 to 20,000 feet. Latest bulletins and engineering data on request.

You get all these outstanding benefits with

CONTINENTAL-EMSCO

MASTS

FOR EVERY DRILLING AND WORK-OVER NEED

1 - *Rear Leg Pivot and Ground Level Assembly*

The unit design of the mast, substructure and rear leg pivot makes assembly easy and safe and permits mast to be raised or lowered quickly.

2 - *Exceptional Visibility and Block Clearance*

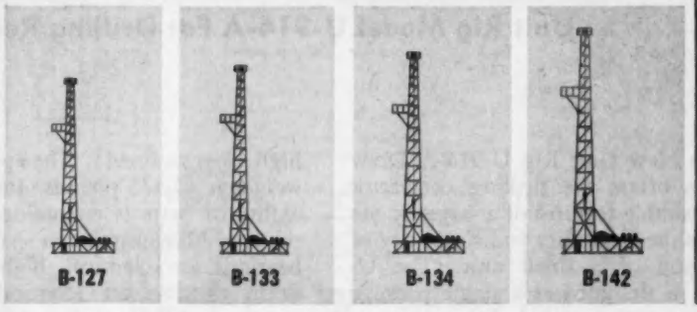
Open face design offers unusual visibility and makes possible fast operation of various size traveling blocks.

3 - *Pin Type Substructure and Mast*

Simplified pin connections for all mast sections speeds up assembly.

4 - *Maximum Portability*

Can be easily moved in one piece or knocked down into sections of roadable widths. Suited for barge installations and in oil fields everywhere.



CONTINENTAL-EMSCO

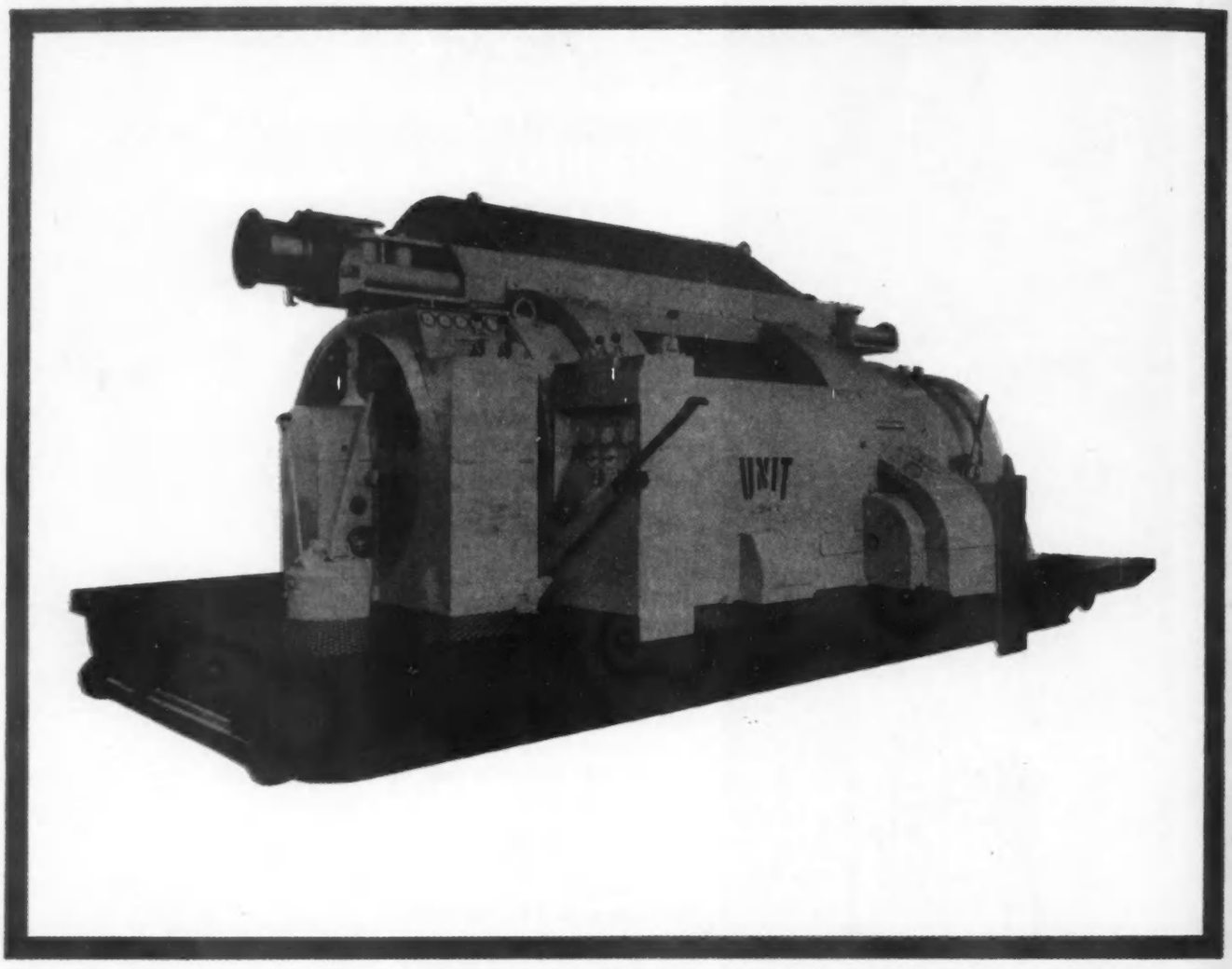
Serving the Oil and Gas Industries ... Worldwide

CONTINENTAL-EMSCO COMPANY

A Division of The Youngstown Sheet and Tube Company

General Offices: DALLAS, TEXAS • Plants: LOS ANGELES • HOUSTON • GARLAND, TEXAS.
Export Division: 48 Rockefeller Plaza, New York, N. Y.
Representatives in All Principal Oil Fields of the World

M-702



A NEW DRAW WORKS FOR MEDIUM TO DEEP DRILLING

Unit Rig Model U-914-A For Drilling Requiring 900 to 1400 H. P.

The New Unit Rig U-914-A Draw Works offers the drilling contractor the desirable features of a large rig yet retains the flexibility and simplicity of operation of a small unit. The U-914-A is designed as a single package unit containing hoisting drum, transmission, rotary drive, and auxiliary brake on a single skid. This unit is rugged in construction and smooth in operation for dependable, trouble free service to meet present day drilling practices of inland or offshore drilling.

The U-914-A is built on a single skid 9′ x 21′ 2″ long and is 8′ 9 7/16″ high (less sandreel). The approximate weight is 45,575 pounds. Interchangeability of parts is maintained through the rig. All transmission shaft support bearings are identical, high and low drum clutches are identical, and all chain is 1¾″ pitch. All sprocket teeth are induction hardened. To prevent corrosion exterior hardware and brake linkage is cadmin plated and iridite finished.

Accessibility for maintenance and service is an important feature of the U-914-A. Inspection covers are provided at convenient points. The drum clutches can be serviced without disassembling the drum shaft. Transmission shafts can be removed independently.

The extra large drum in the U-914-A permits the hoisting of 90 ft. stands with less than three wraps on the spool. The drum barrel is 27″ O.D. x 53¼″ long. Self equalizing, type B drum brakes provide drag free release and easy application. Brake rims are 10″ wide x 52″ O. D., rolled forged alloy steel water circulating. Total braking area is 2900 sq. in. with 320° wrap. The auxiliary brake is

Advertisement

mounted on the main skid and is connected to the drum shaft through a sliding gea rtype overrunning clutch. Hydromatic or dynamatic auxiliary brakes can be mounted.

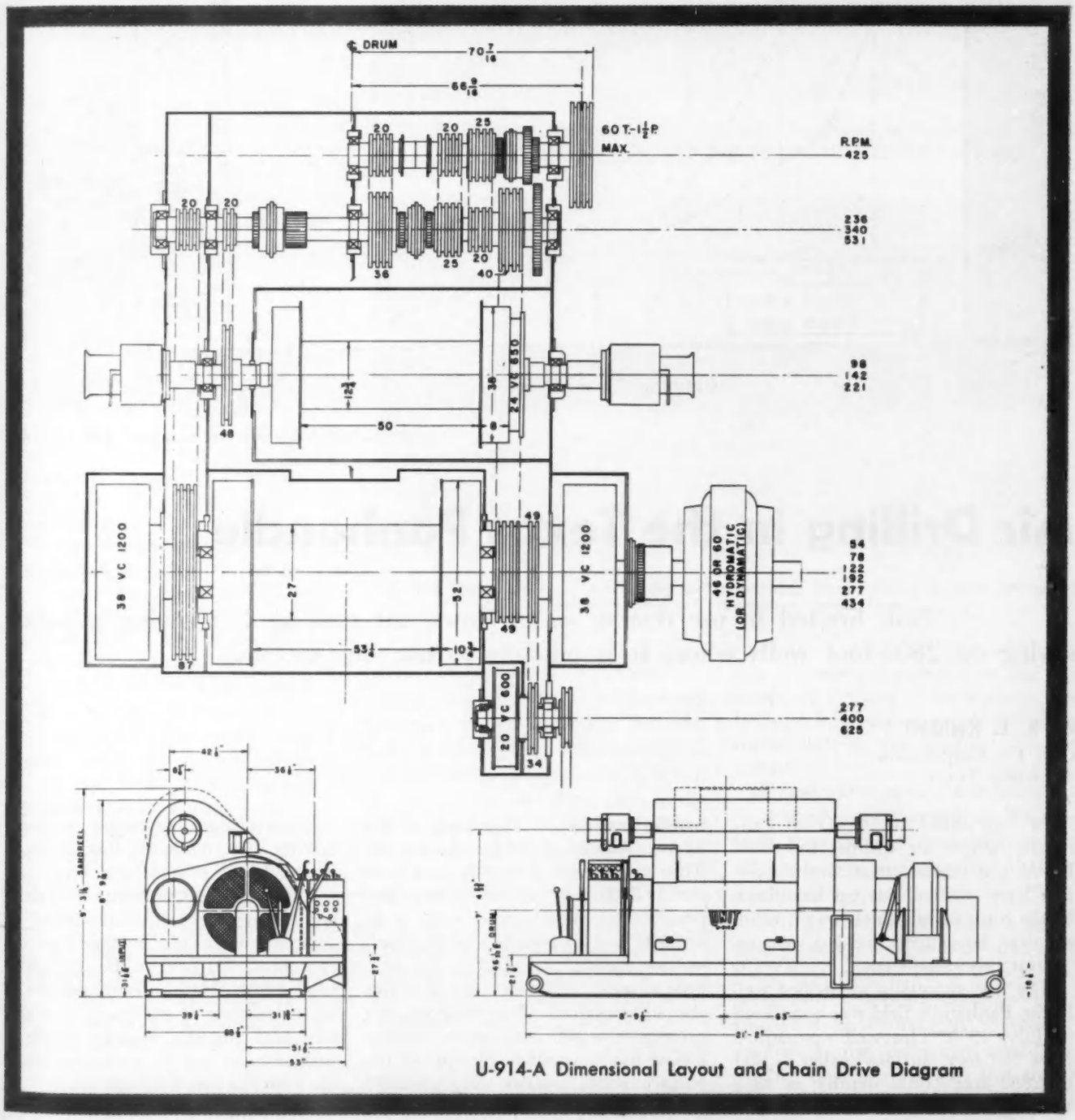
Three forward drives and a sliding gear reverse in the transmission combine with two drum drives to give six forward and two reverse speeds to the drum. One reverse and three forward speeds are available to the rotary countershaft, catshaft, and optional sand reel drum. (See power flow drawing for individual shaft speeds.)

The U-914-A has identical high and low Fawick 38" VC-1200 Ventorque drum clutches with a positive lock-in on the low clutch. The rotary drive is a 20" VC-600 Fawick Ventorque and the sand line drum clutch is a 24" VC-650 Fawick Ventorque. Transmission clutches and low drive disconnecting clutch are splined gear tooth type.

The transmission is lubricated by two chain driven oil pumps. The discharges are manifolded and either pump can furnish adequate lubrication. A centralized grease lubrication system is provided for the brake linkage. Lubrication can be accomplished while the rig is in operation.

All draw works drive chains are 1¾" pitch. The high and low drum drives and transmission chains are 1¾" pitch quad. The rotary and catshaft drives are 1¾" pitch double.

Field experience, engineering know-how and precision manufacturing have been combined to develop the U-914-A draw works. For complete information on this new rig contact Unit Rig & Equipment Co., Tulsa, Oklahoma. Export sales are handled by Mid-Continent Supply Company, 45 Rockefeller Plaza, New York 20, New York.



U-914-A Dimensional Layout and Chain Drive Diagram

For more data on advertised products, use Readers' Service Cards, last page.

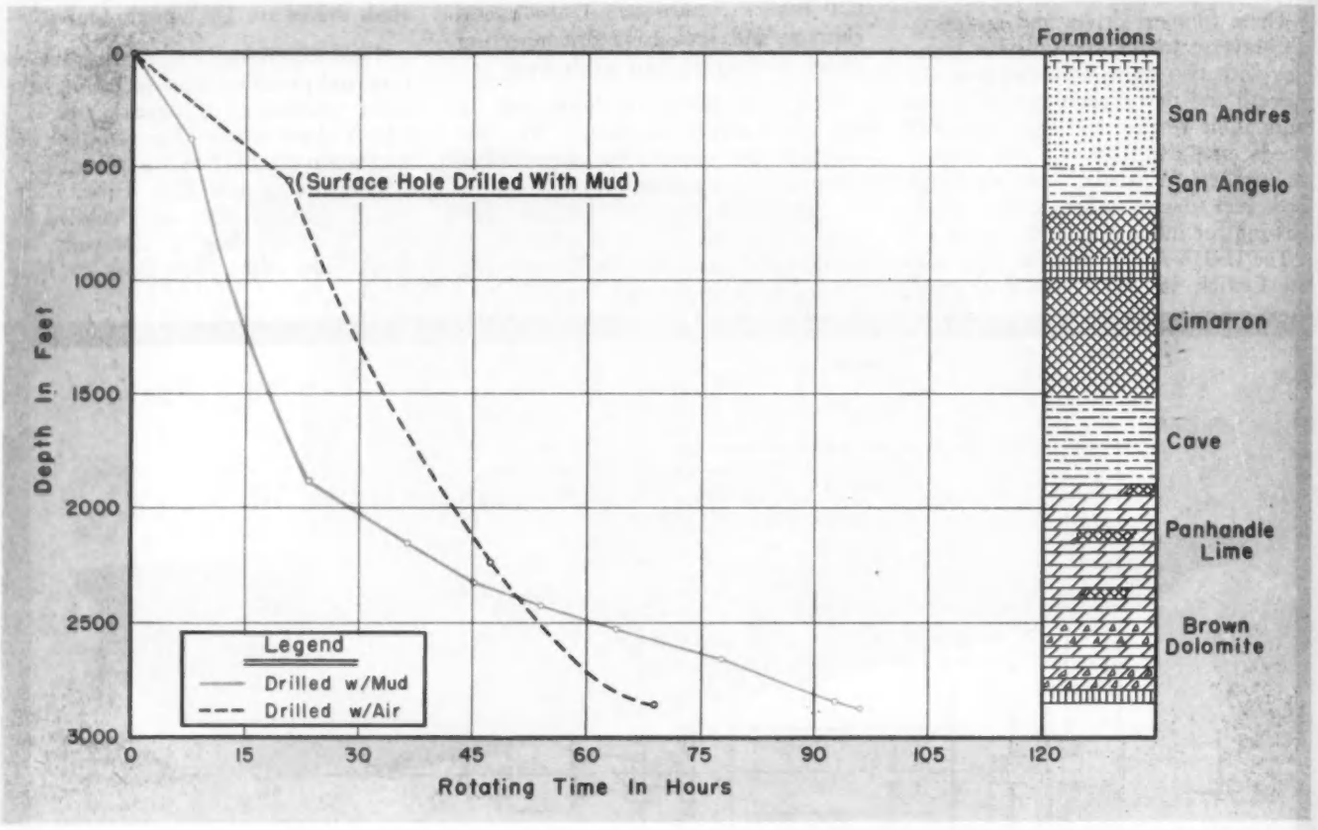


FIGURE 1—Well drilled with mud versus well drilled with air.

Air Drilling in the Texas Panhandle

Still limited in use due to water flows, air drilling is showing a $1600 saving on 2800-foot wells where it is possible to use this method.

By R. L. KNIGHT
Gulf Oil Corporation
Amarillo, Texas

IN THE AREAS of the Texas Panhandle where air drilling has been found practicable, considerable savings have resulted. Savings have been in the form of bits, fuel, water, mud, rig time, fewer trips and less wear on contractor's equipment.

The first successful air drilled well in the Panhandle field was completed in July, 1955. This well was drilled from 563 feet (surface casing depth) to 2860 feet (total depth) in 48½ rotating hours. Penetration rate averaged 47.3 feet per hour.

The air drilled wells in the Panhandle field were completed in the Lower Albany dolomite formation. This pay section generally occurs at about 2900 feet to 3200 feet. The practice for mud drilled wells is to set 350 feet to 500 feet of 8⅝-inch surface casing and drill a 7⅞-inch hole to total depth. In order to utilize the advantage of air circulation, approximately 200 feet more surface casing has to be set to case off all the surface water section. Any quantity of water that bleeds into the bore hole at a point high in the hole will, in most cases, shut down air drilling and necessitate reverting to mud drilling. The moderate fluid invasion in the lower part of the hole (pay section) does not interrupt air drilling. These wells are air drilled to completion depth after fluids are encountered 100 feet to 200 feet above total depth. Here, a high volume of air circulation is necessary to maintain high annular velocity which in turn reduces any plastering or bridging effect of wet cuttings.

At first, it was thought that air volumes giving 2500 feet to 3000 feet per minute annular velocity would

be sufficient to drill these wells. Actual experience has taught that volumes of air effecting an annular velocity of 4000 feet to 5000 feet per minute must be used. The higher annular velocity saves on bits, increases penetration rate, and reduces the bridging effect of the cuttings when moisture is encountered.

To air drill these wells, conventional bits with the water courses cut out are used. Field experience indicates the best practice is to run the same type bits on the air drilled wells that are used on mud drilled wells.

The average air drilled well requires three bits and the average mud drilled well takes eight bits. Figure 1. The penetration rate in drilling from approximately 700 feet to 1800 feet is 100 feet per hour; from 1800 feet to 2400 feet it is 45 feet per hour; and from 2400 feet to total depth (3100 feet) it is approximately 30 feet per hour. In the softer formations, rotating speed does more for penetration rate than bit weight. In the first 1000 feet of the hole drilled, the rotary speed is approximately 100 revolutions per minute with a bit weight of 12,000 pounds to 15,000 pounds. In the lower part of the hole, the rotary speed is reduced to 65 rpm to 80 rpm and bit weight is increased to 20,000 pounds to 22,000 pounds. Maximum penetration rate and bit life are achieved by following this procedure.

No crooked hole problem has been encountered in any of the air drilled wells in the Panhandle field. It is believed that if crooked hole formations are encountered in wells drilled with air, the hole will go off vertical faster than wells circulated with fluid.

The air circulation pressures range from 60 pounds per square inch at a point below the surface casing to 160 psi maximum as total depth is approached. The higher pressure is due mainly to fluid entrance into the bore hole.

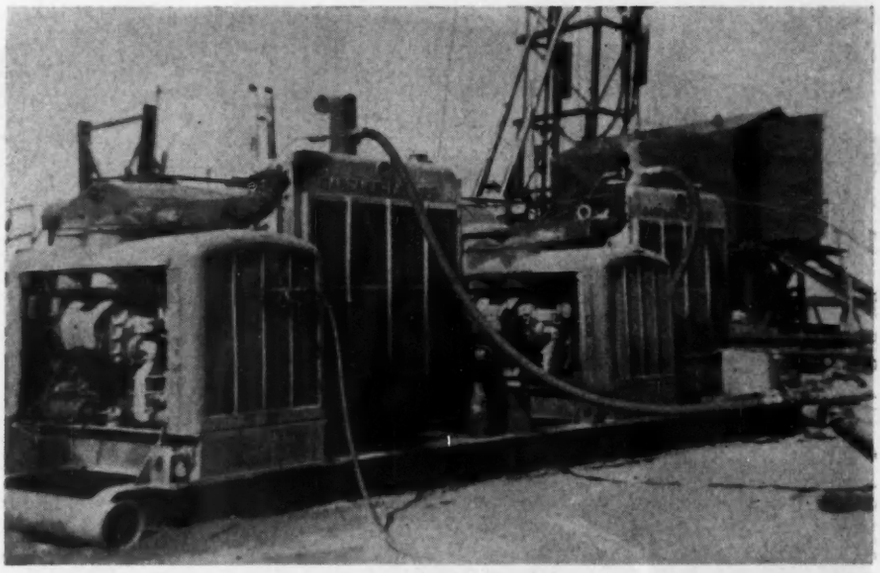


FIGURE 2—Equipment used on Panhandle field wells: Two diesels each develop 150 hp with V-belt drive to compressor. Air compressors maximum output is 525 cfm; 240 psi.

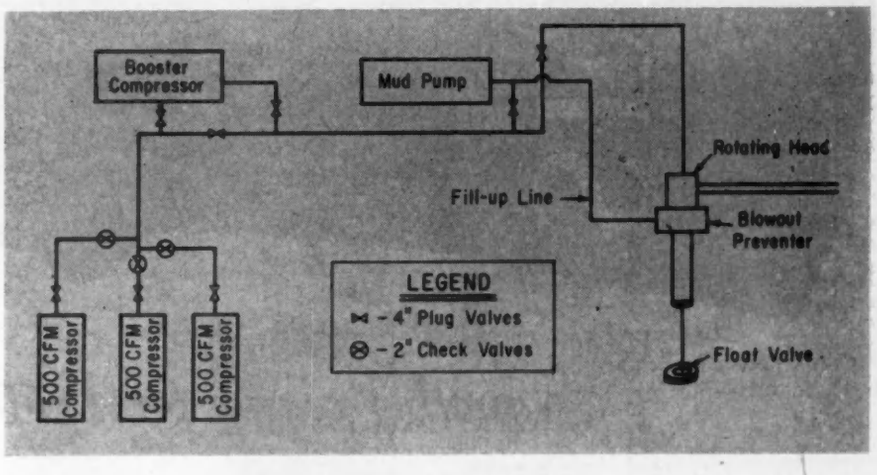


FIGURE 3—Schematic drawing of piping and manifolding for air drilling hook-up. Panhandle field (development well), Hutchinson County, Texas.

At approximately 2600 feet, the top of the gas section is encountered. In order to eliminate any fire hazards, a pilot light is kept burning at the end of the flow line which is laid to a burn pit a safe distance from the rig. It also serves as a distinct marker for the top of the gas section. The gas is burned continuously. An increase in the size of the blaze in the burn pit is, of course, an indication of an increase in the gas from the gas section.

A float valve is used above the bit so that no gas can return to the surface through the drill pipe when making a trip to change bits, making a connection, etc.

Coring with air has been a problem; however, it is believed that with the present techniques of slow rotary speed and a constant coring weight, successful air coring can be accomplished. It has been determined by cutting shorter cores (25 feet to 30 feet), that air blasting the core away from the barrel is largely eliminated. Coring pressures vary from 180 psi

ERRATA

In Arthur Lubinski's article: "How Severe Is That Dogleg?" in the February 1, 1957, issue of WORLD OIL the following errata are noted:

1. Page 102, Column 2, third line from the top of page should read: 4° 15′ per 100 feet instead of 4.5° per 100 feet.
2. Page 104, equation 15 should be:

$$\Delta a = 2 \arcsin \sqrt{\left(\sin \frac{\Delta v}{2}\right)^2 + \left(\sin^2 \frac{\Delta h}{2}\right)\left(\sin v_o\right)\left(\sin v_,\right)} \qquad (15)$$

3. Page 104, the Discussion was submitted by R. B. McCloy.

—another reason for TOTCO on your rig

TOTCO men make the rough calls in stride... hundreds of trips into swamps, in the desert, and over boggy roads at night and in storms. Our service organization will go on making all the trips you need anytime, anywhere.

But the *values in service* to you are (1) trained men able and *willing* to help you, and (2) our responsibility to build the finest Recorder... one that will give the ultimate in trouble-free operation.

The TOTCO service organization has been building for twenty years... a long-time association with drilling requirements. You'll find TOTCO organized to gain your appreciation... because our service is based on what we've learned you want.

Technical Oil Tool Corp., Ltd.
1057 N. La Brea Ave., Los Angeles 38, Calif.

Exclusive Distributors

California—The Republic Supply Company of California
Domestic—The Continental Supply Company
Canada—Oil Well Supply Company
Export—Lucey Export Corporation, New York City

TOTCO Recorder

YOU CAN TAKE TOTCO READINGS ANYTIME

Run in and out on measuring line.

Dropped down drill pipe; picked up with core barrel overshot.

Dropped down drill pipe; recovered when bit is changed.

Run in the Recorder connected to a core barrel overshot when picking up a retractable core barrel.

Run in and out on ordinary sand line.

Be **SURE** *you know, use* **TOTCO**

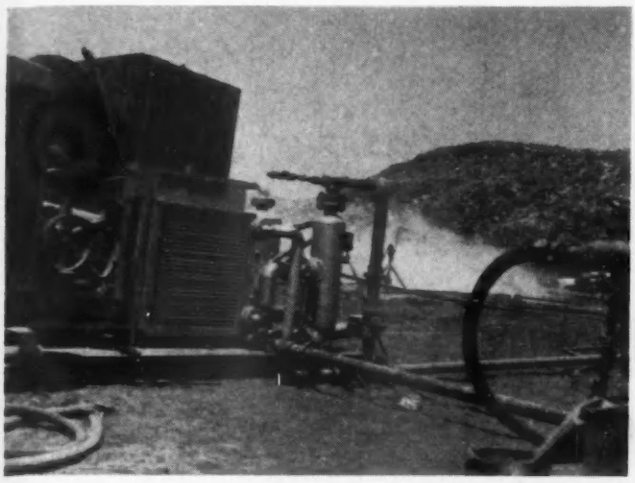


FIGURE 4—Returns from the lime sections at approximately 2200 feet with booster standby unit in the foreground.

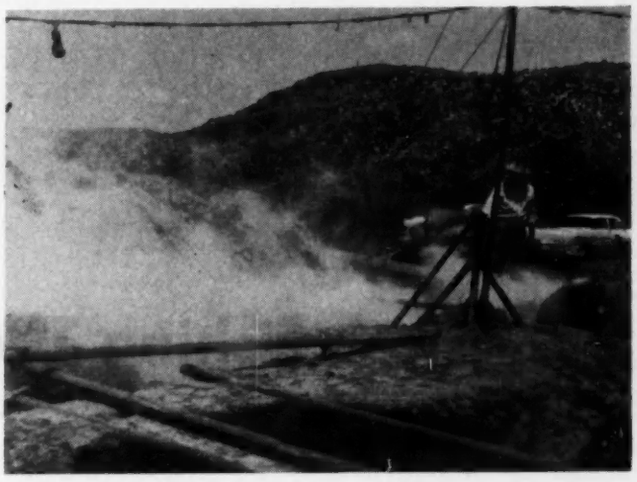


FIGURE 5—Dust returns from the lime section at approximately 2200 feet. Return velocity is 3350 feet per minute. Air pressure—240 to 250 pounds.

to 300 psi depending on how much fluid is bleeding into the bore hole.

As a safety measure, it is recommended that no air be pumped into a large body of oil. Should the hole accumulate 500 feet to 600 feet or more of fluid, it can be jetted from the hole in stages. The amount of fluid to be blown from the hole in one stage is determined by the air pressure available at the surface. Suggested amount of pressure to use is no more than 200 psi.

Another hazard that is present is the possibility of a down-the-hole explosion. In an effort to minimize this hazard, two steps are followed:

- No valve, preventer or gate is closed against the well after oil or gas is encountered while air is in the hole.
- The heat of compressed air is reduced by water cooling the air before injecting it into the well.

This eliminates any "closed vessel condition." Cool air also minimizes damage to the contractor's drill pipe. To date no down-the-hole explosions have been experienced in this field.

Geological interpretation of samples obtained from air drilled holes is difficult. The cuttings are much smaller than mud samples and when drilling in lines, they are in the form of powder. On dry-drilled wells where no fluids are present, all formation tops are identifiable from color of returns at the end of the vent line, up to the time when formation gas appears at the burn pit. The main difficulty in the Panhandle field is encountered in the lower part of the hole where water and oil are found together. This situation contaminates the cuttings with water and/or oil.

Better techniques for securing good identifiable samples for the geologists must be worked out.

Conventional electric logging is not possible in the absence of liquid in holes; however, the logs that do not depend on the presence of conductive fluids in the hole can be used.

The running of casing and the cementing procedures are practically the same as are used in a cable tool drilled hole. No serious difficulty has been experienced in running and cementing casing; however, there is some evidence that cement jobs may not have been as good as in wells drilled with mud.

Should the hole be making excessive amounts of gas, the procedure used is to pump water or oil through the drill pipe to kill the gas flow before running casing. No bit change is required after the top of the gas section is encountered.

The following is an average cost comparison for drilling by air and by mud:

	Mud	Air
Footage Drilling Cost:....	$9,455.00	$7,595.00*
Mud Cost:.....	500.00	.....
Total Cost.....	$9,955.00	$7,595.00
Cost of Additional Surface Casing, Cement, etc.....		750.00
	.....	$8,345.00

*Contractor furnishes air compressors and other air drilling equipment.

The operating company realizes approximately $1600 saving per well, while the contractors' ratio of profit on air drilled wells is approximately the same as on mud drilled wells.

Air drilling's success depends primarily on surface water shut-off. This has been obtained by setting the surface casing in the top of the salt section. If, in order to obtain a water shut-off, 500 feet or more of surface casing is required in addition to that amount used for mud drilling, then air drilling is not economically ad-

Continued on Page 122

About the Author

R. L. KNIGHT has been employed by Gulf Oil Corporation since 1934 and has advanced to zone drilling engineer in the Texas Panhandle. His immediate position before this was as a mud engineer and drilling foreman in West Texas.

For three and one half years he was with the U. S. Army Air Force and spent part of that time in the China-Burma-India Theater as an aerial engineer. In 1948, he was "loaned" to the Danish-American Gulf Prospecting Company in Denmark from the Fort Worth Production division for the purpose of supervising the drilling mud program for a deep test and training Danish personnel as mud engineers.

Fishing Tools and Techniques Part 2— Interspersed Carbide

Fractured carbide fragments bonded to a matrix and applied to all types of downhole cutting tools and bits have radically speeded up fishing and cutting operations.

By WELDON L. MEDDERS
Chief Engineer, HOMCO, Houston

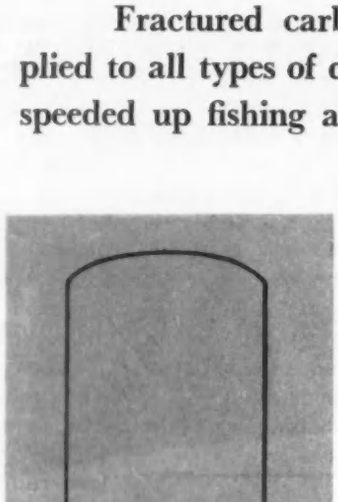


FIGURE 10—Pipe rotary shoe made from washpipe—teeth cut with a torch.

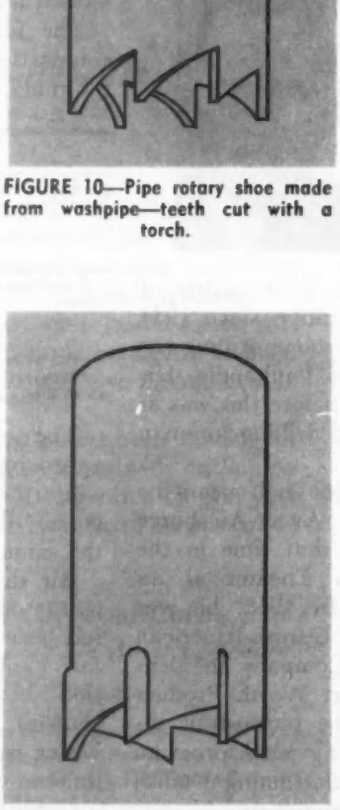


FIGURE 11—Conventional alloy steel rotary shoe with hard faced teeth.

IN THE ATTEMPT to keep up with the pace set by the rest of the industry, the fishing tool industry has produced some worthwhile results. However, of all types of recovery the washover or "outside" job has perhaps been the most difficult to cope with. When pipe becomes stuck and can neither be pulled nor jarred from the hole, it becomes necessary to wash over the fish and cut the formation away foot by foot.

In the early days a pipe shoe was used for washing over stuck pipe. These shoes made from washpipe were generally 6 to 8 feet long. The teeth were cut on the bottom with a torch as shown in Figure 10. Soft metal was used to build-up the teeth to gage. Later, as wells deepened and the going got rougher, it became necessary to use heat-treated, alloy forgings and hardface on the cutting edges with tube metal or powdered tungsten carbide (Figure 11). These shoes were used from 1945 to 1955 and are still in use today, although they are now becoming obsolete.

To complicate the process of washing over stuck pipe, there is very little working room or clearance between the O.D. of the stuck tool joints or drill collars and the I.D. of the drilled hole. In recent years there has been a marked tendency in drilling practices toward the further restriction of this clearance by the use of large O.D. drill collars.

Slim hole drilling has superimposed even further restrictions on washovers that are almost insurmountable.

From the very beginning of the slim hole program, drilling engineers have been aware of this problem. The need for high-tensile, streamlined washover equipment was forcefully communicated to the fishing tool industry.

Perhaps the most significant development to grow out of this request has been the development of material known generally as "clustered carbide." With this cutting material it is possible to manufacture a slim hole rotary shoe that will outperform and outlast the conventional hard-faced, saw-tooth shoe at the rate of seven to one. Thus, it is now possible to complete a slim hole washover

job in less time than was formerly required to do a job in a full-size bore hole where there was considerably more clearances between the hole and the pipe.

A completely new approach to down hole cutting is materializing from the use of "clustered carbide." The "clustered carbide" consists of a specially blended matrix throughout which fractured carbide fragments are interspersed. This sounds simple, however, the blending of the matrix is a metallurgical undertaking that requires both patience and ingenuity. Sintered carbide slugs, such as are used in lathe cutting tools, are first fractured into jagged fragments about ⅛-inch to 3/16-inch in cross-section. These fragments together with the matrix are then applied to cutting tools, core heads, rotary shoes, junk mills, and pilot mills (Figures 12 through 17). This process is similar to the method of setting diamonds in a shoe or bit, except that the carbide fragments are not spaced in any geometrical pattern. The carbide fragments are bonded to the matrix on all sides, while diamonds are held in their sockets mechanically.

This method of applying carbide fragments is not to be confused with the method of applying carbide slugs to a shoe. There is no comparison in the over-all result. The regularly shaped slugs, due to their relatively large size and rigid installation are, like all sintered carbide, subject to fracture under shock loading and can be easily broken with a hammer. Accordingly, under the severe shock-loading encountered in a steel-cutting washover operation, these rather large particles can be expected to chip and break. Also, due to their size, they are difficult to bond without some oxidation. The small fragments, on the other hand, are supported on all sizes by the matrix or bonding material which is resilient enough to allow some movement of the carbide particles under impact. Thus the matrix serves as a sort of shock absorber and is still tough enough to hold together under severe loading.

These advantages accrue:

1. **Economical for** difficult washover jobs and hard formation cutting.
2. **Numerous Cutting Edges.** When one cutting edge dulls, another takes over, until the entire matrix is exhausted. This self-sharpening feature means more footage per shoe or bit and a consequent reduction in the number of trips required to complete a job.
3. **Carbide particles** cannot become unsocketed or dislodged during the cutting operation.
4. **Risk is reduced.** Lost-in-the-hole price will be about one fifth that of other comparable products.

At Lake Salvador recently a salt water flow interrupted a drilling operation at 7494 feet, causing sand, lime and shale to slough and freeze the drill pipe all the way from 3018 feet to the bottom of the well. Since it was impossible to circulate, it was decided to washover and cut.

The job was started with a 9¼-inch O.D. 5-tooth, 5-rib, conventional rotary shoe. From 3018 feet, this shoe drilled 285 feet to 3303 feet in 7 hours, and was worn beyond further usage. Next, a 9¼-inch O.D. 10-tooth conventional shoe was tried and made 94 feet in 8 hours. A 9¼-inch 8-tooth standard shoe was then used and it burned up after making 168 feet. The first outside cut was then made at 3563 feet. It should be noted that four,

FIGURE 12—Carbide cutting knives from carbide section milling tool.

3-hour round trips of the wash pipe were necessary to make the first outside cut. Thus a total of 12 hours was spent in handling the pipe. Time on bottom was 21 hours.

Trip time increases with depth, so it was seen that handling time alone at 7000 feet would amount to approximately 20 hours.

In order to speed up this operation, it was decided to run a 9¼-inch O.D. 8-tooth clustered carbide shoe. Starting at 3564 feet, the carbide shoe went the length of the wash pipe, 627 feet, in 18 hours. The second cut was made at 4129 feet.

The same carbide shoe was rerun and made 484 feet

FIGURE 13—Core head made with clustered carbide.

in 22 hours. Cut #3 was made at 4632 feet. Total footage with first shoe: 1111 feet.

Since the first clustered carbide shoe showed signs of wear, a new shoe was run with the following results:

Started Drilling at	Drilled to	Footage	Time on Bottom in Hours	Outside Cut Made at
4675 Ft.	5261 Ft.	586 Ft.	15	5196 Ft.
5261 Ft.	5826 Ft.	565 Ft.	20	5762 Ft.
5825 Ft.	6391 Ft.	566 Ft.	21	6328 Ft.
Total		1717 Ft.	56	3 cuts made

A third carbide shoe was used to finish the job:

Started Drilling at	Drilled to	Footage	Time on Bottom in Hours	Outside Cut Made at
6391 Ft.	6954 Ft.	563 Ft.	22	6895 Ft.
6954 Ft.	7335 Ft.	381 Ft.	13.5	7303 Ft.
Total		944 Ft.	35.5	7303 Ft.

The three conventional shoes made an average of 183 feet; the carbide shoes averaged 1257 feet. The carbide shoe outcut the standard shoes by 7 to 1. On a product cost basis this would mean a savings of $423 per 1000 feet.

By using clustered carbide shoes it was possible to make cuts #2 through 8 with only two round trips per cut, or a total of 14; whereas, if standard shoes had been used, it was estimated that at least 28 trips would have been required. In eliminating the 14 trips it was estimated that 57.8 hours of rig time were saved, which is a considerable figure.

On another job out of Harvey, La., the effectiveness of clustered carbide in attempting to recover stuck drill pipe is shown. One thing led to another until junk consisting of a piece of a box tap, part of a die nipple, a 4-foot slab of casing, and four sets of hardened and ground tool steel cutter knives had collected around the drill pipe over a 9-foot section of hole.

For a week all attempts to burn up this junk with conventional rotary shoes failed. In fact, on the last run a 9¼-inch O.D. standard shoe was left in the hole to complicate the job.

During a period of 36 hours, two 9¼-inch clustered carbide shoes burned up this junk, while making a total of 10 feet. The first shoe ran 26 hours and showed considerable wear. The second shoe ran 10 hours and was almost as good as new when retrieved.

Table 3 gives the results of a number of field runs with carbide rotary shoes. Table 4 lists the results of conventional shoes run on the same jobs under the same conditions as shown in Table 3. By comparing the average footage at the end of both tables, the superiority of the carbide product is evident.

In the Sherman, Texas, area a contractor encountered difficulty in coming out of the hole and hung up a 6-inch O.D. x 2½-in I.D. change-over sub 3 feet long and one 6-inch drill collar 29½ feet long under the surface pipe. The change-over sub and collar were partly imbedded in the sidewall beneath the surface pipe and partly extending into open hole. The collars were wall-stuck and, with the surface pipe directly above the collars, a washover job was out of the question. A milling or burning operation was the only thing that could save the hole.

Using three specially made carbide rotary shoes, the 3-foot change-over sub and 29½-foot-long drill collar were split longitudinally. The cutting edges of the shoe bisected the bore hole of the collars all the way, so that half of the collars were left in the sidewall and the other half, 32½-feet long, was brought out of the hole. This opened up the bore hole of the well to full diameter for the resumption of normal operations.

Turning at 30 to 40 revolutions per minute with 5000 pounds weight, this operation proceeded at the rate of 18 inches per hour, setting a penetration record for this type of job. The whole job took three days. However, the actual running time was in the neighborhood of 29 hours. The other time was used for circulating, changing shoes and waiting on equipment.

A photograph of a segment of this collar is shown in Figure 18.

Before the advent of clustered carbides this job would have required from 10 to 12 days using a conventional mild steel burning shoe.

Figure 19 shows a roller type reamer which looks as

TABLE 3—Field Reports Carbide Rotary Shoe

AREA	Size Shoe	Description of Material or Formation Cut	Penetration Rate Per Hr.	Total Time Rotating	Total Footage	Remarks
Brookhaven, Mississippi	4⅝" OD x 3⅝" ID	3 ft. of packer mandrel and part of 2⅜" OD perforated joint.	.46 Ft.	13 Hrs.	6 Ft.	Shoe worn to base metal, Recovered fish.
Brookhaven, Mississippi	4⅝" OD x 3⅝" ID	2 junk rock bit cones and cross bars and 20 ft. of tightly consolidated formation.	5.5 Ft.	4 Hrs.	22 Ft.	Shoe badly worn. Recovered fish.
Edinburg, Texas.....	4 13/16" OD x 4 3/16" ID	Air tubing slips fell out of bowl into hole on top of fishing tools and wedged tools at 4090 ft. inside 5½"-815lb casing; Carburized slip was ⅝" thick, 2½" wide and 3" long.	.33 Ft.	5 Hrs.	1.65 Ft.	Recovered tools and fish.
Lake Salvador, Louisiana	9¼" OD x 8-tooth	Hard sand, lime and shale.	27.7 Ft.	40 Hrs.	1111 Ft.	Shoe worn.
Lake Salvador, Louisiana	9¼" OD x 8-tooth	Hard sand, line and shale.	30.6 Ft.	56 Hrs.	1717 Ft.	Shoe worn.
Lake Salvador, Louisiana	9¼" OD x 8-tooth	Hard sand, line and shale.	26.2 Ft.	36 Hrs.	944 Ft.	Shoe still in good condition.
White Court, Alberta, Canada	5½" OD	Stuck 5" OD test tool with 78 ft. of anchor on bottom.	3 Ft.	2 Hrs.	6 Ft.	Cut 5" OD test tool to 4⅝" dia., pulled shoe, ran overshot and pulled test tool and anchor pipe out of hole.
Sherman, Texas.....	9¼" OD	Stuck drill collars and bit with pieces of junk rotary shoes on top.	2.33 Ft.	3 Hrs.	7 Ft.	Milled side of drill collars and pieces of rotary shoes to get over fish. Fish recovered.
Hobbs, New Mexico....	4⅝" OD x 3¾" ID	Packer with hold down.	.12 Ft.	12 Hrs.	1.5 Ft.	Cut packer loose and recovered same.
Brookhaven, Mississippi	9⅜" OD x 7⅛" ID	Pieces of junk rotary shoe 12" long and stuck drill collars.	3.1 Ft.	20 Hrs.	62 Ft.	Shoe worn.
Harvey, Louisiana.....	9¼" OD	Junk consisting of 1—9¼" OD rotary shoe, a piece of a box tap, part of a die nipple, a four ft. slab of 10¾" casing, and 4 sets of hardened and ground outside cutter knives. Junk was accumulated around stuck drill pipe over a 9-ft. section of the hole.	.28 Ft.	26 Hrs.	7.28 Ft.	Shoe badly worn.
Harvey, Louisiana.....	9¼" OD	Junk consisting of 1—9¼" OD rotary shoe, a piece of a box tap, part of a die nipple, a 4-ft. slab of 10¾" casing, and 4 sets of hardened and ground outside cutter knives. Junk was accumulated around stuck drill pipe over a 9-ft section of the hole.	.27 Ft.	10 Hrs.	2.72 Ft.	Shoe in good condition.
White Castle, Louisiana.	9¼" OD	Sandy shale with hard streaks, lime, and anhydrite.	52.8 Ft.	120 Hrs.	6340 Ft.	Shoe worn out.
Casper, Wyoming.....	5⅞" OD	5" OD packer and slips.	.5 Ft.	5 Hrs.	2.5 Ft.	Cut over top sub and top slips, released packer and pulled same out of hole.
Casper, Wyoming.....	5⅞" OD	5¾" OD retrievable packer.	1 Ft.	1 Hr.	1 Ft.	Recovered packer.
Victoria, Texas.....	4¾" OD x 3¾" ID	2 joints 2" EUE tubing and squeeze tool cemented inside 5½"-17lb casing.	5.4 Ft.	14 Hrs.	76 Ft.	Shoe showed some wear,
Sherman, Texas.....	4⅝" OD	1 joint 2⅞"-N80 tubing and packer cemented on hole against casing wall.	3 Ft.	8 Hrs.	24 Ft.	Burned top 4 ft. of tubing off and washed to packer, burned top slips off.
		TOTAL FOOTAGE	10,331.65 Ft.			
		AVERAGE FOOTAGE	607.74 Ft.			

TABLE 4—Field Reports Conventional Hard Faced Rotary Shoes

AREA	Size Shoe	Description of Material or Formation Cut	Penetration Rate Per Hr.	Total Time Rotating	Total Footage	Remarks
Lake Salvador, Louisiana	9¼" OD 5-tooth	Hard sand, lime and shale.	40.5	7 Hrs.	284	Shoe worn out.
Lake Salvador, Louisiana	9¼" OD 10-tooth	Hard sand, lime and shale.	11.7	8 Hrs.	94	Shoe worn out.
Lake Salvador, Louisiana	9¼" OD	Hard sand, lime and shale.	28	6 Hrs.	168	Shoe worn out.
Sherman, Texas.....	9¼" OD	Stuck drill collars and bit.	0	19 Hrs.	0	Left parts of shoes in hole. Could not get over fish.
Sherman, Texas.....	9¼" OD	Stuck drill collars and bit.	0		0	Again left parts of shoe in hole. Could not burn over top of fish.
Hobbs, New Mexico....	4⅝" OD	Packer with hold down.	.0061	39 Hrs.	.25	Made 3" in 39 hours. Shoe burned up.
Brookhaven, Mississippi.	9⅜" OD	Stuck drill collars.	42.4	2.5 Hrs.	106	Shoe worn out.
Brookhaven, Mississippi	9⅜" OD	Stuck drill collars.	1.16	6 Hrs.	7	Shoe worn out,
Brookhaven, Mississippi	9⅜" OD	Stuck drill collars.	1.2	2.5 Hrs.	3	Shoe worn out.
Harvey, Louisiana.....	9¼" OD	Junk, consisting of a box tap, part of a die nipple, a 4 ft. slab of 10¾" casing, and 4 sets outside cutter knives.	0	unknown	0	Actually, several attempts were made over a period of a week to burn up this junk with conventional shoes. The net result was no penetration.
White Castle, Louisiana.	9¼" OD 8-tooth	Sandy shale with hard streaks, lime and anhydrite.	30	5 Hrs.	150	Burned shoe up.
White Castle, Louisiana.	9¼" OD 10-tooth	Sandy shale with hard streaks, lime and anhydrite.	30.7	7 Hrs.	215	Burned shoe up.
Sherman, Texas.....	4⅝" OD	1 joint 2⅞" N80 tubing and packer cemented in hole against casing wall.	0	unknown	0	Failed to wash over upper end of fish with conventional shoe.
		TOTAL FOOTAGE	1027.25			
		AVERAGE FOOTAGE	79.02			

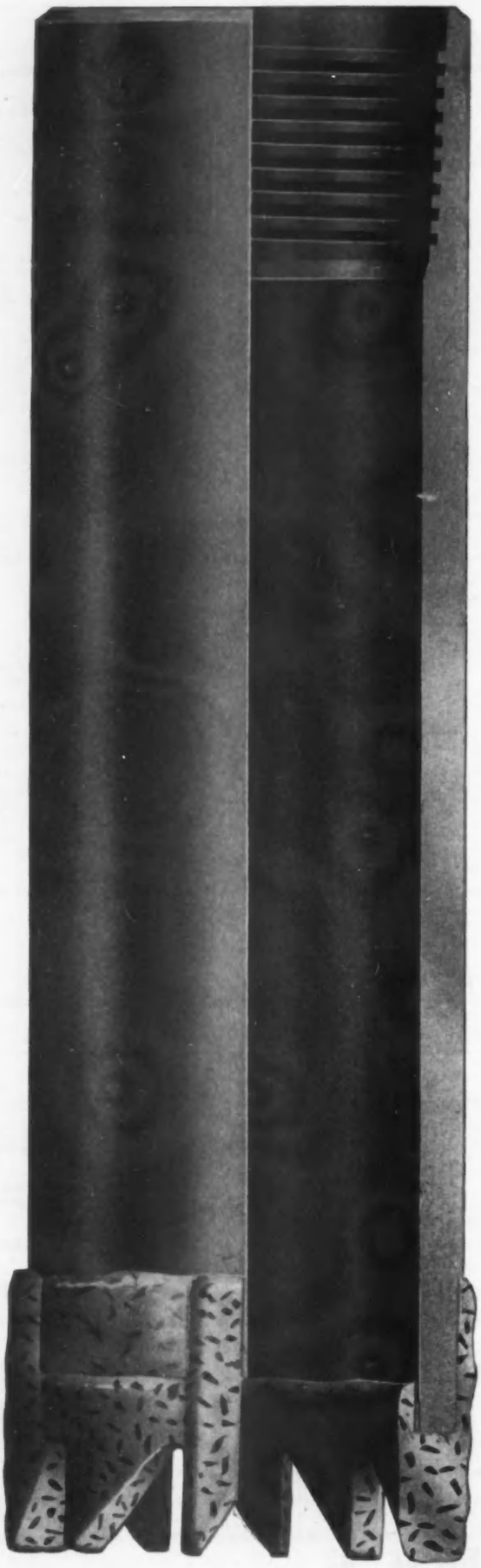


FIGURE 14—Wash drawing of a carbide cutting type rotary shoe.

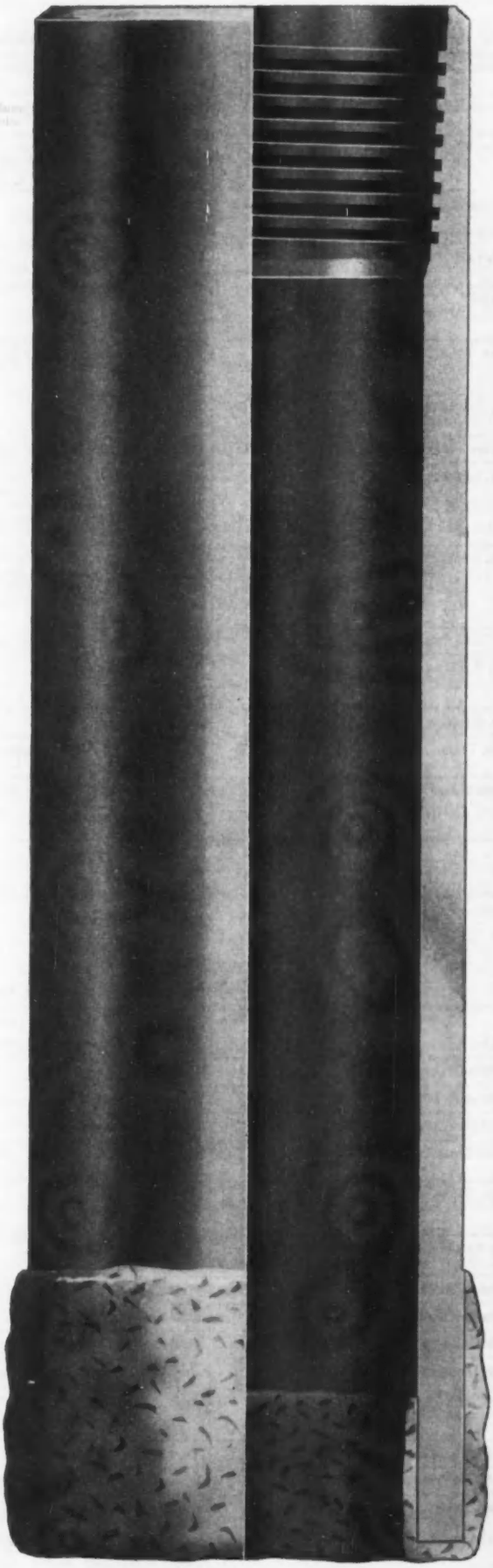
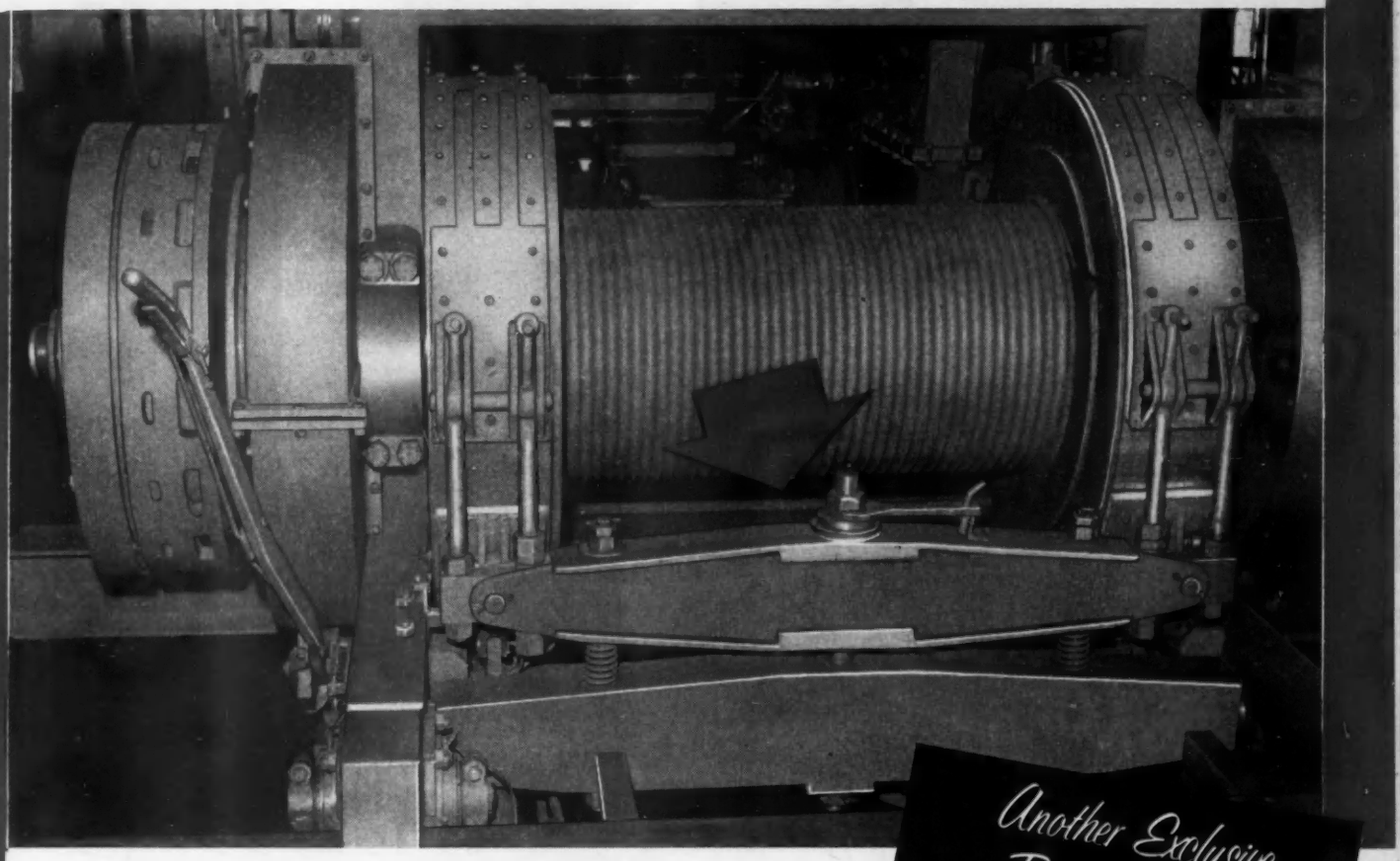


FIGURE 15—Wash drawing of a carbide burning type rotary shoe.

Advanced...New...Sensational...

ONLY on WILSON SUPER RIGS!



NEW FRONT EQUALIZER BEAM TYPE BRAKE . . .

Absolutely no other line of rigs in the world have this feature. Wilson . . . always years ahead . . . with the most modern and sensational rigs in the world again sets the pace with the ALL NEW FRONT EQUALIZER BEAM TYPE BRAKE. Important . . . you bet! To the driller it means spectacularly SMOOTHER, more PIN-POINT PERFECT braking throughout drilling operations. So far ahead of all others, the *ENTIRELY* NEW Wilson Braking System has become one of the most appreciated features of Wilson SUPER Rigs because they are SAFE and *WILL NOT KICK.*

So check your rig. To be strictly MODERN and SAFE it has to be a Wilson . . . THE NEWEST OF NEW! Write for our New Catalog No. 257.

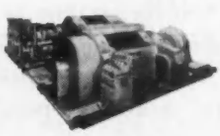
BE MODERN — BUY WILSON

WILSON

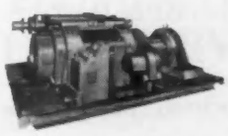
MANUFACTURING CO., INC.

WICHITA FALLS, TEXAS, U. S. A.

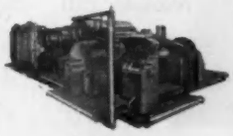
The Home of RED IRON



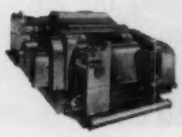
Super Titan "66"
22,000 Ft.—4½" Drill Pipe
25,000 Ft.—3½" Drill Pipe



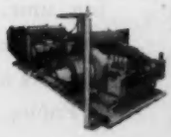
Super Titan "56"
15,000 Ft.—4½" Drill Pipe
19,000 Ft.—3½" Drill Pipe



Super Atlas
11,000 Ft.—4½" Drill Pipe
13,000 Ft.—3½" Drill Pipe



Super Giant
9,000 Ft.—4½" Drill Pipe
11,000 Ft.—3½" Drill Pipe



Super Mogul
7,500 Ft.—4½" Drill Pipe
8,500 Ft.—3½" Drill Pipe

A WHOLE NEW LINE OF RIGS

FIGURE 16—Junk mill with clustered carbide.

FIGURE 17—Carbide pilot mill.

FIGURE 18—Segment of a drill collar cut by a carbide shoe.

though it were cut in a machine shop rather than down hole. This operation took place at Camp Trivino, Old Mexico. The job was difficult in that the formation was very hard sand, the average penetration for a diamond bit being only three feet per hour. In the drilling operation, the sand would fracture and heave, so that the fish, consisting of three drill collars, in 8½-inch bottom hole roller type reamer, and an 8½-inch rock bit, would restick before the washover shoe could be pulled and a retrieving string run back in the hole. About the only way to get this fish was to wash over the entire fish in one operation, come out of the hole as quickly as possible and then go back with jars.

A 7⅝-inch special flat-bottomed carbide shoe did the trick, rewashing over 90 feet of drill collars (drill collars were shaved about 1/16-inch on the side from end to end), and then milling over the reamer and cutting into the shank of the bit, all in 18½ hours including circulating time. After milling the rollers off the reamer and milling part of the bit shank, it was possible to go in with the jars and jar the fish out of the heaving sand.

Figure 20 shows portions of collapsed 2-inch, N-80 tubing which was wadded up inside 7-inch casing with 1100 feet of free tubing below. The collapsed tubing was milled up and the 1100 feet of free tubing recovered.

CORING WITH INTERSPERSED CARBIDE

In the field of hard formation coring, clustered carbide may effect still further economies. At about one-fourth the cost, the carbide fragments will compete with diamonds in some formations.

A representative run was made at Plains, Texas. A 25-foot core was cut, resulting in a 100 percent recovery. The top five feet was upper Mississippian, consisting of hard, light green shale and lime tightly consolidated with a very abrasive sand. The remaining 20 feet was the Woodford black shale, difficult because particles of vagrant pyrites from the formation cause the cutting elements of conventional coring bits to come loose and fall out, making further penetration impossible.

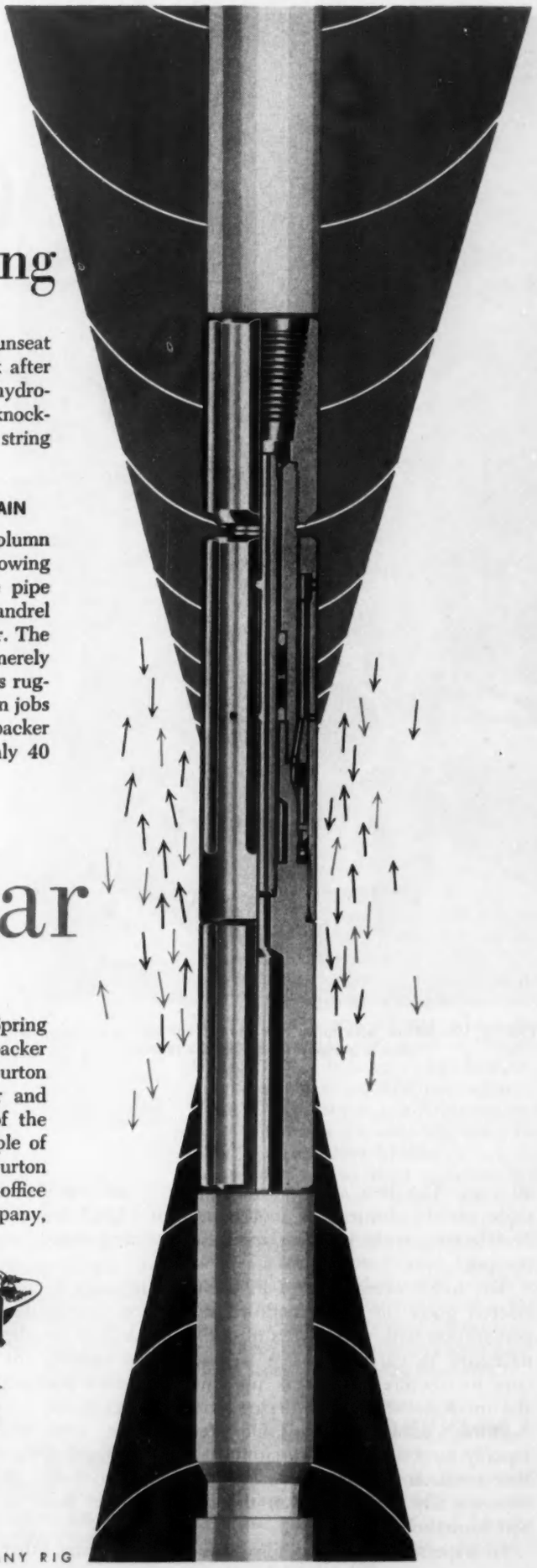
Using a 6⅛-inch O.D. by 3½-inch I.D. carbide head, coring started at 11,405 feet. The best coring time in the abrasive Mississippian of 13 minutes per foot was from 11,408 feet to 11,409 feet with 16,000 pounds weight, 1200 pounds pump pressure, and a rotary speed of

Saves strain on rig and running-in string

No need to use the running-in string as a "yo-yo" to unseat and release packer or anchor if either become stuck after a drill stem test. Halliburton's Hydraulic Jar uses the hydrostatic pressure of the fluid column to deliver the "knock-out" punch. You save strains on rig and running-in string ... and you also save valuable rig-time and tools.

CAN BE COCKED AND RE-COCKED AGAIN AND AGAIN

An upward pull against the weight of the fluid column causes the hydraulic system to release suddenly, allowing the mandrel to move quickly. The tension in the pipe supplies the energy to cause the shoulder on the mandrel to deliver a sharp blow to the stuck packer or anchor. The Jar can be cocked and re-cocked again and again merely by slacking off pipe weight as when packer is set. Its ruggedness and dependability have been demonstrated on jobs requiring hours of repeated jarring to release stuck packer or anchor. Yet, this powerful, efficient tool adds only 40 inches to the length of the testing string.



HALLIBURTON'S

Hydraulic Jar

A SMOOTH-WORKING TEAM OF TESTING TOOLS

Effective combinations of by-pass valves in Hydro-Spring Tester and VR Safety Joint associated with proper packer clearance, make it easier to run in faster with a Halliburton Testing String. The Hydraulic Jar makes it easier and quicker to unseat packer or anchor to come out of the hole when the test is completed. Just another example of the smooth working testing team that makes Halliburton best for your drill stem test. Call the local or district office or write the Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

ASK FOR BULLETIN:
"Halliburton Formation Testing"

HALLIBURTON

OIL WELL CEMENTING COMPANY

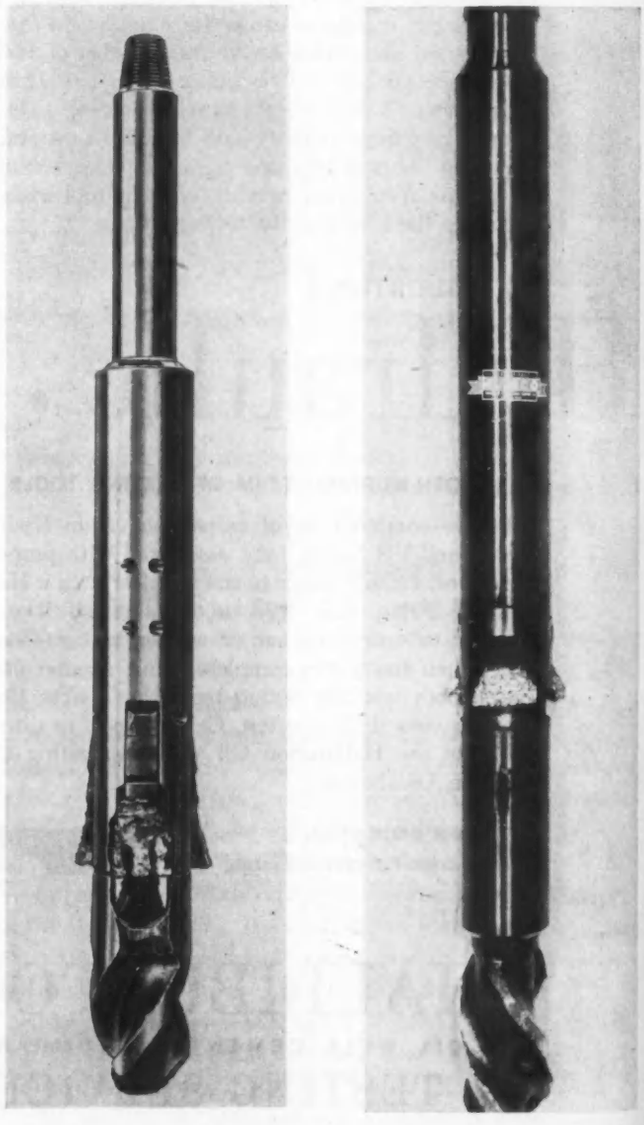
TESTING SERVICE

251 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG

For more data on advertised products, use Readers' Service Cards, last page.

FIGURE 19—Bottom hole roller type reamer cut with a carbide shoe. Shoe is propped up beside the reamer.

FIGURE 20—Portions of 2-inch collapsed N-80 tubing which was milled with clustered carbide.



FIGURES 21 and 22—Photos of the section milling tools with carbide blades.

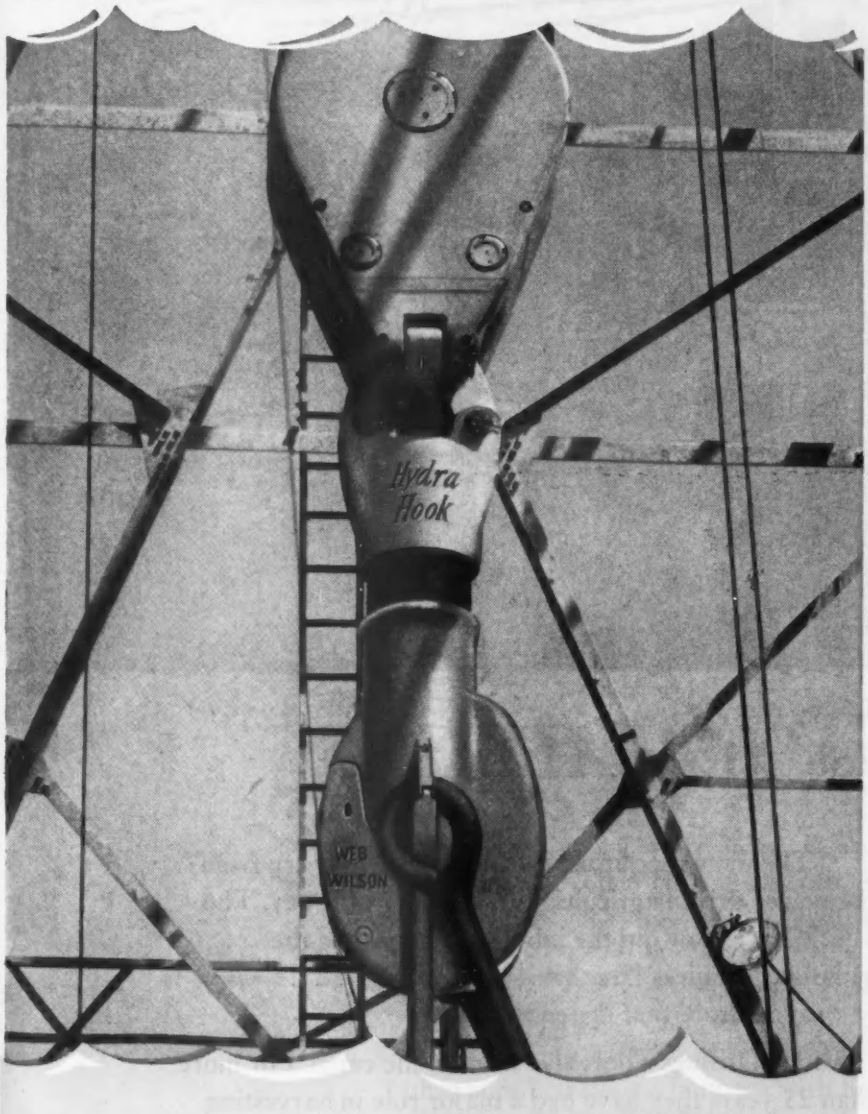
40 rpm. The best coring time in the Woodford black shale of 31 minutes per foot was from 11,415 feet to 11,416 feet, with 15,000 pounds weight and rotary at 50 rpm.

The total coring time of 21 hours 38 minutes is considered good for the Woodford shale. For comparable penetration with other types of coring heads, it is usually necessary to carry excessive weights, often causing the core to fracture and break up, and sometimes packing the inner barrel and hindering further penetration.

Other coring jobs with clustered carbide, were not equally successful. It is apparent at this writing that further research must be done before this product will be economically competitive in the field of either hard or soft formation coring.

Interspersed carbide is also speeding up many other

SEA-GOING HOOKS

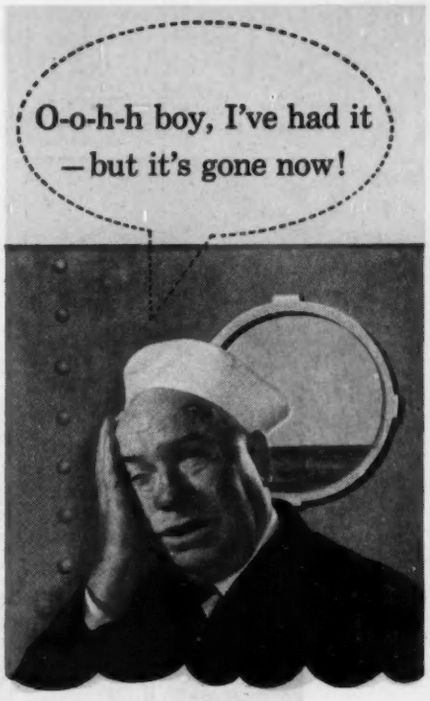


OFFSHORE OR ON-SHORE you see more and more WEB WILSON *HYDRA HOOKS everywhere.* ★ Never before has there been a hook so compact and streamlined, so fast and safe to operate. ★ *HYDRA HOOKS* come in seven sizes, from the 450-Tonner, shown in action on an offshore rig, to a 40-ton size for small rigs. *There's one just right for you!*

WEB WILSON

OIL TOOLS, INC.

LOS ANGELES/DALLAS/NEW YORK

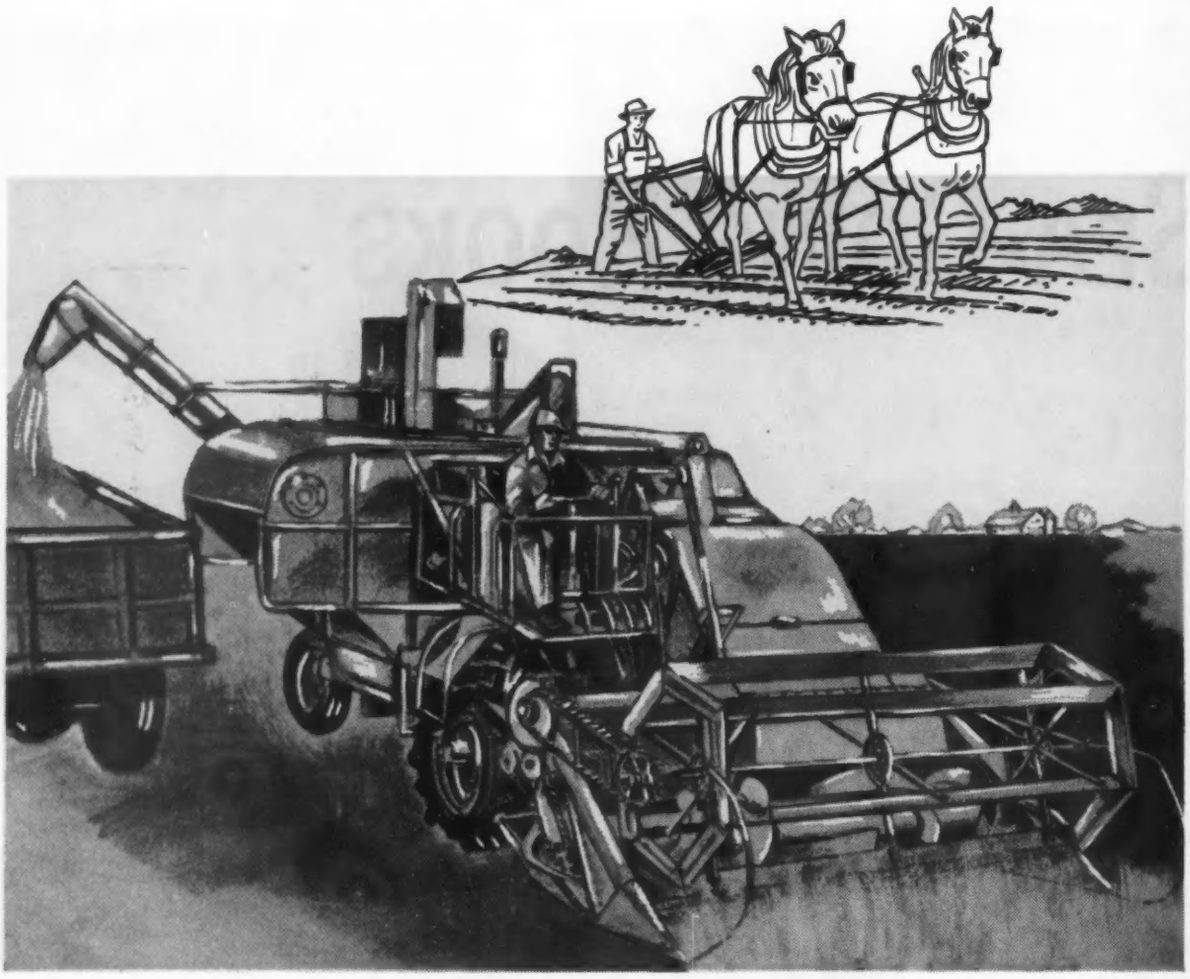


Just got back from an offshore trip—out in a crew boat and went aboard in a swinging basket. Didn't know a man could be so sick and live through it! ★ Ensign Deaver and Midshipman Spiller, who peddle Web Wilson Oil Tools down in the Cajun country, asked me to help 'em close a deal on an offshore rig—and I'll never forgive those two jokers. Not only did I lose everything I'd eaten for three days, but I lost part of my reputation as a "super-salesman"—and that's BAD. ★ Had my sales spiel all polished up, but how can you be convincing when you have to dash to the side and feed the fishes every 30 seconds? ★ Never had a better chance to sew up a complete-rig deal, matching up the proper Web Wilson Links and Elevator to a big *HYDRA HOOK,* with a set of "Heavy Weight" Web Wilson Tongs hanging around ready to go. And then—blooey—IKE N. SELLEM was IKE N. HEAVE, and how! ★ Soon as I'm able will head for West Texas and New Mexico (where the waves don't run so high) and help Bill Harries and Barney Barnett sell some Web Wilson *TIGER TOOTH* Tong Dies. There's a *real* tong die that takes ahold good—I oughta know because I'm using one until my new denture is ready, to replace the one I tossed overboard in the Gulf. ★ Hope I'm feeling better next month so I can sell you fellers something. I'll be seein' you—on dry land only!

Ike N. Sellem

P.S. *I've been wondering how Deaver and Spiller managed to close that "complete rig" deal after I pooped out. Maybe they're better salesmen than I figured—and better sailors, too.*

For more data on advertised products, use Readers' Service Cards, last page.



progress in FARMING

The plow that broke the plains was a far cry from the power driven agricultural machinery of today. The simple plow did the job well, but feeding the world today requires "mechanized farming" . . . agriculture that depends on oil.

Globe Drilling Tools also work in the earth. For more than 25 years they have had a major role in harvesting a bumper crop . . . petroleum to feed "hungry machines" throughout the world.

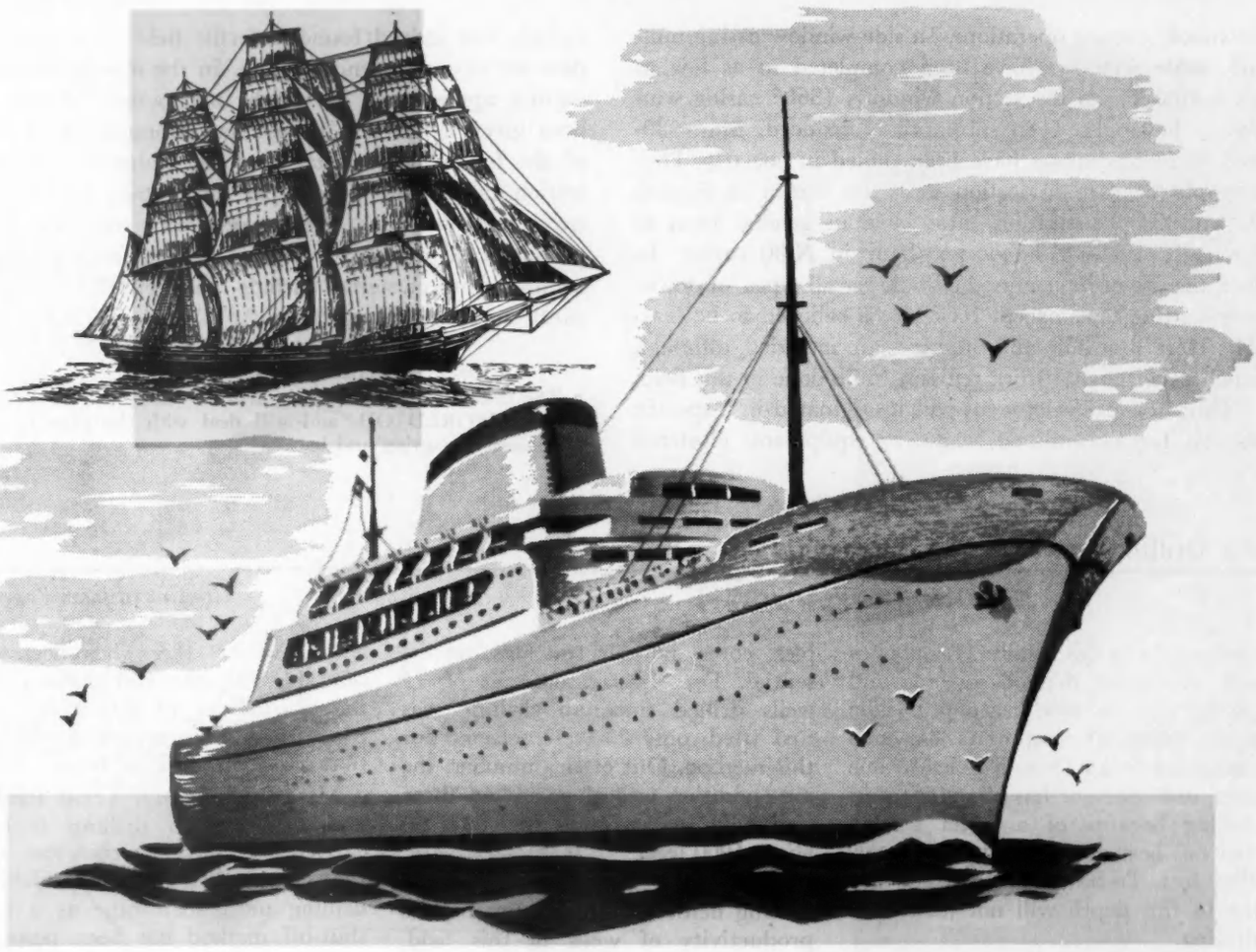
GLOBE OIL TOOLS CO.

GLOBE "S52C" ROCK BIT

Main Office and Plant: LOS NIETOS, CALIFORNIA

Branches In All Principal Drilling Areas Offer Prompt Service To Meet Your Drilling Needs

MORE THAN 25 YEARS SERVICE TO THE OIL INDUSTRY



progress ON THE SEA

Swift, graceful clipper ships were once the pride of this nation's maritime fleet. We should be no less proud of today's modern fleet of power driven ships, busily engaged in transporting passengers and cargo to the markets of the world.

Contributing to this "sea-going" power, Globe has supplied the oil industry with fine drilling bits . . . bits that help take oil from the earth in order that it may be used at sea.

GLOBE "SS3C" ROCK BIT

GLOBE OIL TOOLS CO.

Main Office and Plant: LOS NIETOS, CALIFORNIA

Branches In All Principal Drilling Areas Offer Prompt Service To Meet Your Drilling Needs

MORE THAN 25 YEARS SERVICE TO THE OIL INDUSTRY

For more data on advertised products, use Readers' Service Cards, last page.

downhole cutting operations. In side-window casing milling, some windows have been completed in as few as six hours. Times for section windows (360° casing windows) have also been substantially reduced. Many 30- and 40-foot windows have been milled in one trip. Photographs of carbide section mills are shown in Figures 21 and 22. Penetration rates have in general been at the rate of about 1-foot per hour in N-80 casing. In fact, the use of interspersed carbide for all types of downhole cutting tools except rock bits is believed to be feasible. Here shot hole and drag bits are included, although much experimental work remains to be done in this field.

Thus, for a development which originated in a specific request for streamlined washover equipment, clustered carbide has indeed found a fertile field. The results to date are extremely encouraging. In the several downhole cutting applications in which interspersed carbide has been given a fair test, its use has afforded one or more of the following advantages: sharp reductions in penetration rate, more footage per bit or tool, fewer round trips, fewer misruns, greater resistance to shock, lower product cost, and less customer risk. As a metallurgical achievement, clustered carbide has contributed significantly to drilling progress.

EDITOR'S NOTE

The third in this series of six articles will appear in the April issue of WORLD OIL and will deal with the pipe recovery operations of cutting and back-off.

Air Drilling in the Texas Panhandle

Continued from Page 109

vantageous in this locality. Economics will, of course, depend on hole and casing size as well as depth. The prior statement concerns 8⅝-inch casing set in an 11-inch hole. In one area, one operator has abandoned air drilling because of a water section that has been found at approximately 1900 feet. To have to set surface casing to this depth will not justify air drilling.

Due to the above limitations, it has been practicable to utilize air drilling in only certain areas in the Panhandle field, and to further restrict its use to those wells where neither good samples, cores, nor electric logs are essential. For this reason, out of 74 wells drilled since air drilling was first tried, only 23 were selected for this method. Out of this number, the air operation was given up on three wells due to encountering fluid at about 1900 feet.

To date, it is indicated that air drilling neither improves nor impairs productivity of wells in this field, where fracture treatments prior to completion are the common practice.

The future prospects for air drilling deep wells in the Panhandle appear to be rather remote at the present; however, there has been considerable thought and discussion on the possibilities of adjusting casing program to allow a considerable portion of a deep hole to be air drilled.

Most areas in the Texas Panhandle, where deep drilling is being carried on, have several loss zones that carry water and will prohibit air drilling until such time as a water shut-off method has been perfected.

ACKNOWLEDGMENT

The authors express thanks to E. A. Weichert, Gulf Oil Corporation; H. P. Goodrich, Panhandle Drilling Company, Inc. (formerly with Drilling and Exploration Company of Delaware, Inc.), and F. W. Smith, Technical Drilling Services Company, for their assistance in preparing this article.

AAODC's 1956 Statistics Reveal Changes in Contractor Situation

OIL WELL DRILLING data and cost statistics released by the American Association of Oilwell Drilling Contractors reveal several changes in the contractor's technical and economic situation during 1956.

Brad Mills, executive vice president of the AAODC, said the recently completed study shows that "the drilling contractor completed 93 percent of all wells and again performed a major feat in drilling more wells and footage with fewer rigs at 1944 footage prices."

Mills also pointed out that the 1956 weighted average contract cost of $4.75 represented only 34 percent of the total cost of drilling, which last year averaged $13.75 per foot. In 1944, the contract cost was 57 percent of the total, which includes costs of materials and services bought directly by the oil operator. Contract footage prices have actually fallen, in the face of greatly increased costs to the contractor.

"It is strongly indicated that drilling costs will increase during 1957," Mills said, "and it is only reasonable to assume that contract footage prices will be advanced to absorb this rise."

Highlights of AAODC Tables

- Faster drilling times were recorded in 1956. "Rate of penetration"—the time it takes to drill—showed marked improvement over the previous year, and was up 192 percent over the 1941 rate.

- A total of 58,281 new wells was completed in the U. S. last year, up 1421 over 1955. Total drilled footage was 234,350,550. This figure, divided by total number of wells, shows that average well depth was somewhat less than in 1955—4022 feet, compared with 4044.

- Average contract cost per foot fell from $4.90 in 1955 to $4.75. There has been a steady decline since the $5.85 mark of 1952. On the other hand, total cost of drilling has gone up in the same period from $12 to $13.75.

- Contractors drilled 93 percent of all U. S. wells, 54,192 wells and 217,946,012 feet of hole.

- Average number of rotary rigs running in the U. S. and Canada in 1956 was 2846, 27 short of the mark set in 1955. The steel situation, strikes and shortages, cut rig activity sharply following the June peak of 2998.

Unless it's LEBUS GROOVED...*

Your drilling hoist is not modern!

Being modern is a prerequisite now when it comes to drilling rigs. Producers are calling on those operators who stay in front by utilizing the latest developments in drilling equipment. LeBus Grooving and Spooling Systems* make it possible for the operator to have a more modern rig by increasing efficiency, allowing up to 40% deeper drilling with your present rig, faster spooling of wire line, elimination of drum and drawworks vibration and wire line whip caused by bad spooling, which adds up to hundreds of dollars in savings monthly for the rig operator. Modernize your rig through LEBUS GROOVING!*

*LEBUS COUNTERBALANCE SPOOLING

LEBUS LINE LTD

Patent Nos.: Counterbalanced Spooling, Nos. 2,734,695; 2,732,150. Controlled Parallel and Helical Spooling, Nos. 2,708,080; 2,620,996. Appli. of grooving, Nos. 2,599,926; 2,204,938. Removable End Fillers, No. 2,216,819. Other patents pending.

LeBus International Engineers

Executive Offices, Sales, Services & Warehouse • Longview, Texas

For more data on advertised products, use Readers' Service Cards, last page.

HOMCO SUPPLY STORES

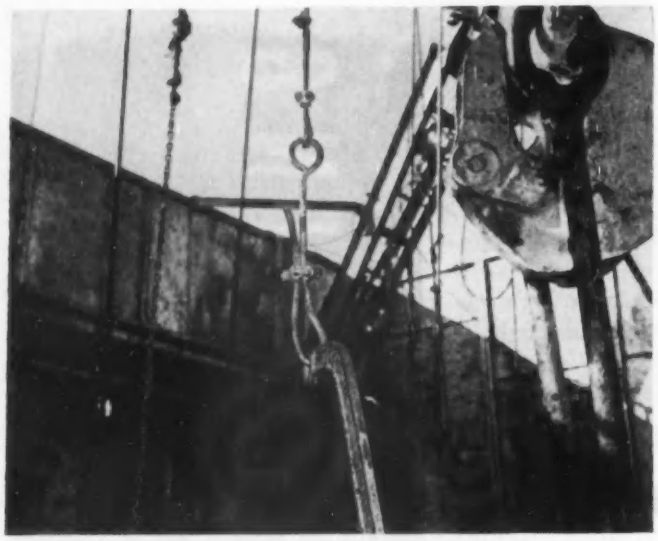


FIGURE 1—Closed-type hook prevents tongs from being knocked off and onto the feet of a crewman.

FIGURE 2—To change tong dies safely, use proper die driver, peen hammer, goggles and gloves.

Hazards on the Rig Floor

By R. G. ARCHIBALD
Calgary, Alberta, Canada

Here are 18 danger areas on the rig floor that account for a great number of accidents each year. How does your safety program measure up?

THE IMPORTANCE of safety around a drilling rig has been pointed out innumerable times in the past. Nevertheless it cannot be stressed too much as lives are still being lost each year on drilling rigs, together with a mountainous total of lost time and no-lost time injuries. These injuries and fatalities have cost contractors and companies a great many dollars. However, a dollar sign cannot be used as a yardstick for measuring the human anguish caused by these injuries and fatalities.

This human suffering can be reduced if time is taken periodically to look at the tools and equipment on our rigs and spend some time teaching the drilling crews the proper method of operation.

A no-lost time injury on a rig may indicate that an employe has had an injury that only requires a bandage administered by himself or possibly a doctor. This is duly recorded and the man returns to work immediately. The cost is only the professional services of a doctor and whatever materials he may use. However, if the same employe has a disabling injury, one that requires him to lose time from his job, the cost mounts. In addition to direct costs such as medical and lost time, the indirect cost of man power replacement and equipment

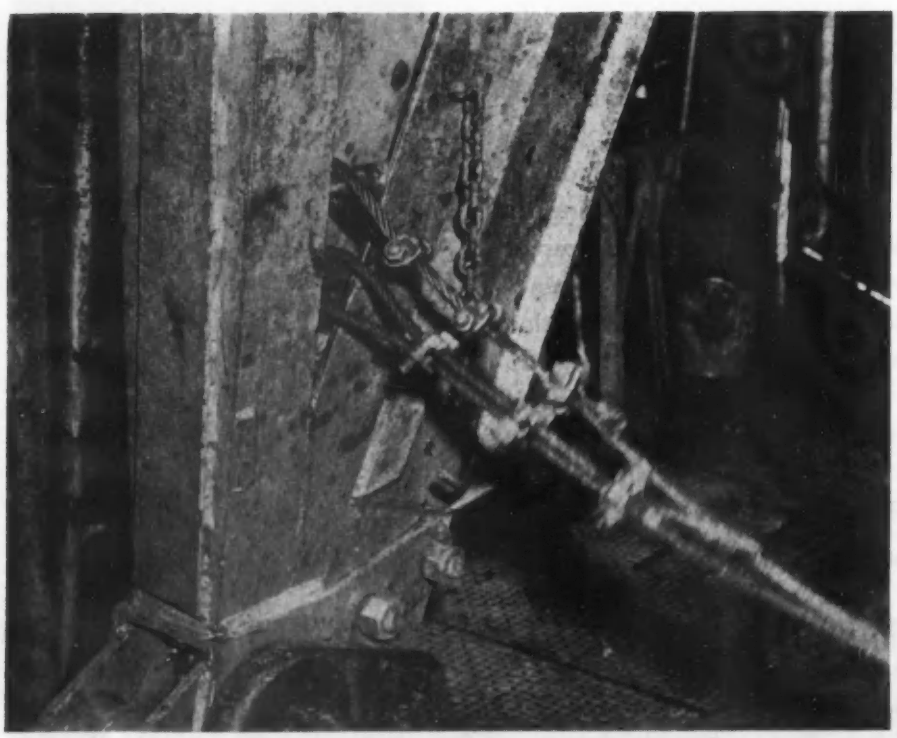


FIGURE 3—Tong safety lines tied to derrick led for greater safety.

HOMCO
HOUSTON OIL FIELD MATERIAL COMPANY, Inc.

SUPPLY STORES

HOMCO
does the job

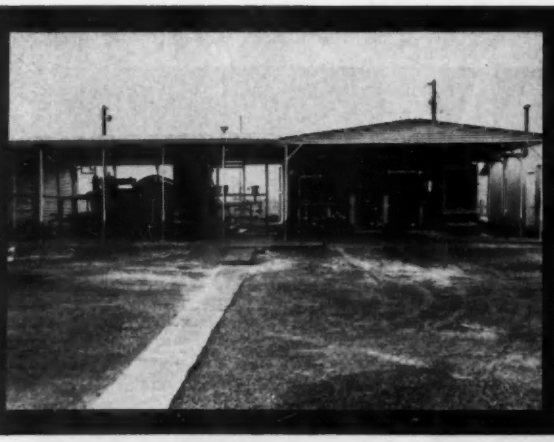
supply and service in the roughest country

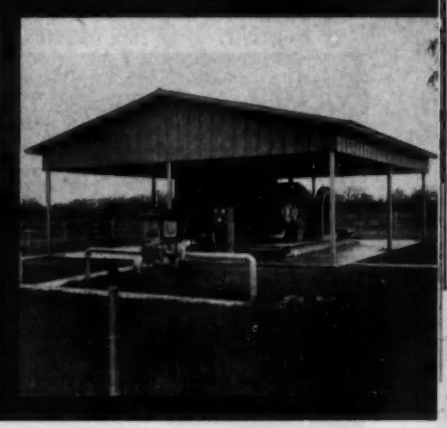
HOMCO portable gas compressor units have been designed for use in locations where moderate quantities of gas must be compressed for purposes such as gas lifts, injection, transmission lines and the like.

HOMCO portable gas compressor units are outstanding in performance, portability, flexibility and economy.

ALL HOMCO units are complete with necessary jacket water coolers, gas coolers and gas scrubbers. All piping between the component parts is supplied and mounted in HOMCO'S manufacturing plant in order that the units will be ready for immediate service upon reaching their destination.

HOMCO will furnish compressors to fit any individual specification.





HOMCO Export Offices

Houston Oil Field Material Company, Inc.,
509 Madison Avenue
New York City, New York

HOMCO de Mexico, S. A.
Edificio Reforma - Versalles
Paseo de la Reforma # 76, desp. 503
Mexico 6, D. F.

THE WORLD'S LARGEST INDEPENDENT OILFIELD SUPPLY AND SERVICE ORGANIZATION
DIRECTIONAL DRILLING
FISHING AND CUTTING
OILFIELD SUPPLIES
ELECTRICAL WELL SERVICE

HOMCO
HOUSTON OIL FIELD MATERIAL COMPANY, Inc.

HOUSTON, TEXAS

THE OIL INDUSTRY'S MOST COMPLETE SERVICE

MEMBER A.A.O.D.C.

RESEARCH — DEVELOPMENT — ENGINEERING — MANUFACTURING

FIGURE 4—Tongs can cause severe injury if not properly adjusted. When tongs are applied, keep the arms stiff.

FIGURE 5—Throwing spinning chain with left hand reduces accident hazards.

repair must be added. This is where footage dollars go needlessly.

Safety on a rig floor is just as essential as a set of tongs or a set of slips. Without safety a drilling rig can never be operated successfully.

Outlined in the following paragraphs are a few of the hazards which have caused a great many injuries on the rig floor.

Pipe Tongs. (Figure 1) First of all, let us consider the most widely used piece of equipment on the floor—the pipe tongs.

Tongs should be hung on a closed-type hook in order that a severe jar will not knock them off and onto the feet of a workman. Often we see tongs suspended on a small open-type hook.

Tong Dies. (Figure 2) A very serious injury to the eyes can result if tong dies are not changed properly. Use proper die driver, pean hammer, goggles and gloves. Never change dies with the tongs suspended over the rotary.

Tong Safety Lines. (Figure 3) Two ⅝-inch wire safety cables on all tongs are a must. Smaller cable will snap under possible tension. Be sure both tong lines have three line clamps on each end of the line, correctly spaced, which is six times the thickness of the wire line apart. Be sure each safety line is anchored separately to a derrick leg or other tie-down. Inspect these lines daily and change when fraying begins.

Operation of Tongs. (Figure 4) Tongs can cause a severe injury if not properly adjusted. When tongs are applied, keep the arms stiff. Any sudden application of power will throw the operator clear of the tongs. If arms are bent or tongs are held and power is applied unexpectedly, the tongs could strike the operator on the ribs or stomach. This has been fatal to some in the past.

Be sure when "breaking pipe" that tongs are well in the clear of the center of the tool joints; should they overlap and power is applied, they will kick-back with considerable force. Stand clear with unusually tight joints.

Throwing Spinning Chain. (Figure 5) Which hand should be used when throwing the spinning chain? This is a very controversial subject. Experience has shown that more injuries

Baroid's new lost circulation material: PLUG-GIT

--shredded hardwood fibers stop loss of circulation

Specially developed to answer tough problems of lost circulation! PLUG-GIT is a *new* Baroid product, processed from shredded hardwood fibers. It quickly builds a matted wall on the face of extremely porous formations.

PLUG-GIT is easily mixed and will not interfere with the operation of your mud pumps. It mats rapidly, doesn't deteriorate, and stands up under high pressure.

Laboratory tests and thorough field trials have proved PLUG-GIT to be a superior lost circulation material. This economical, heavy-duty material is fast becoming a standby wherever lost circulation is a problem.

ACTUAL SIZE
PHOTO OF PLUG-GIT

BAROID

BAROID DIVISION NATIONAL LEAD CO.
Main Office: P. O. Box 1675, Houston 1, Texas

BAROID DIVISION NATIONAL LEAD CO.
Main Office: P. O. Box 1675, Houston 1, Texas

Gentlemen:
Please send me your new data on PLUG-GIT.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

WO

FIGURE 6—When pulling slips three hands are better than one and results in less back injuries.

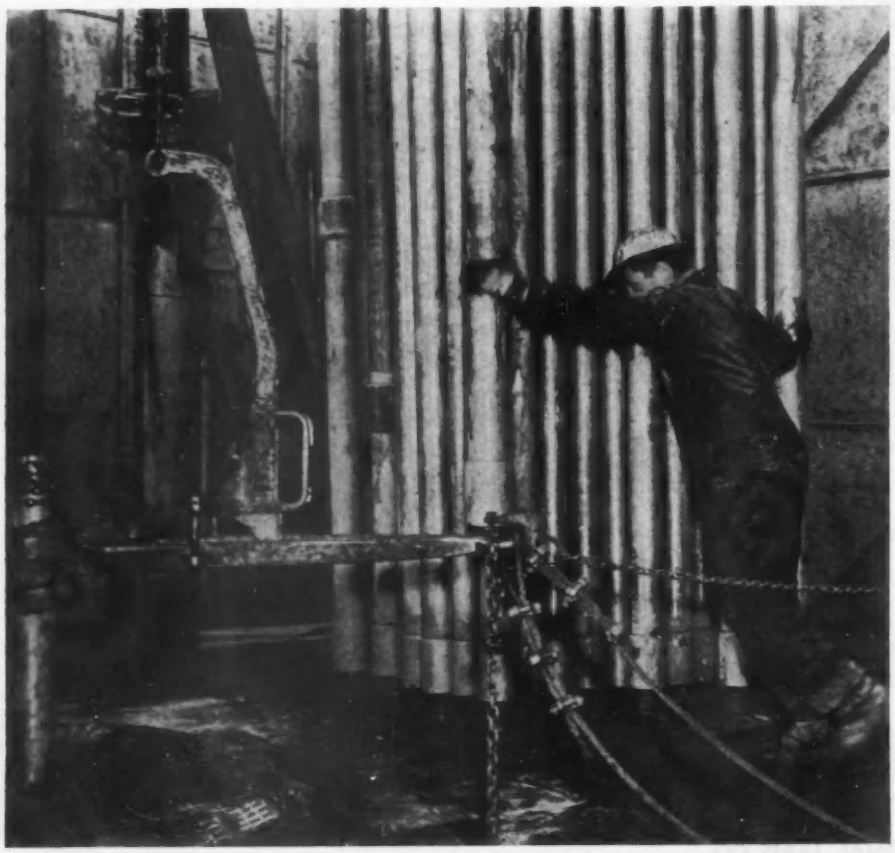


FIGURE 7—Keep feet well back when racking pipe when coming out or running in the hole.

have been reported by men throwing the chain with the right hand than with the left hand. If the chain is thrown with the left hand and it is accidentally fouled with a glove or other clothing, the natural tendency is for the left arm to follow on around to the right. During this time the driller can have the power shut off and maybe prevent a broken arm. This however, is not the case if chain is flipped with the right hand. In this case, in all probability, an arm will be broken. With some practice a man can change from the right to the left hand.

Pulling Slips. (Figure 6) This operation has probably caused more back injuries than any other. The importance of recognizing this hazard is magnified when we are aware that a larger percentage of our lost time injuries are back injuries.

Three hands are better than one when it comes to pulling slips. If all three floormen cooperate with one arm lifting the slips and one supported on the drill pipe, the slips will be much easier to pull. One man, however, can set the slips quite easily. This eliminates the necessity of other floormen reaching across the table and under the tongs for the slip handles while the tongs are on the pipe before breaking the connection.

When setting the slips the feet should be kept back from the handles. If slip handles are hinged at the body of the slips, it is safer. If however, the handles are bolted securely to the slips and toes are underneath when the slips are set, a set of crushed toes could be the result. Hard toe shoes will help here.

Racking Pipe. (Figure 7) This has cost many a toe and foot through the years. The feet should be kept well back from the racked pipe both while coming out and while running in the hole. Should the derrickman "snag" a stand, it will land on the floor with a terrific impact and the floorman's feet will not have a chance. Watch the derrickman as closely as possible so that as he latches onto the pipe, the feet are in the clear.

During winter operations if pipe is racked in a tray with eight inches of water and kept hot with steam, ice plugs will not form in the pipe while out of the hole. If ice is allowed to form in the pipe, it will melt as it

WIRE ROPE AT WORK

When our roving photographer was "doing" the Northwest Sherman Field, near Sherman, Texas, this neat Falcon Seaboard outfit caught his eye. He learned that the rig had easily put down 8400 ft of hole since starting the well, and the crew expected to go another 1100 ft.

In discussing the various rig components, somebody mentioned the rotary line. It was a Bethlehem line, 1¼-in. 6x19 Seale, with 8-part rigging. Though it had seen hard service, it showed very little wear, and everyone agreed that it was more than earning its keep. This is a typical comment on Bethlehem rotary-line performance, for there is no tougher, more durable rope anywhere than that made by Bethlehem.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

PETROLEUM • MINING • QUARRYING • CONSTRUCTION • EXCAVATING • LOGGING • MANUFACTURING

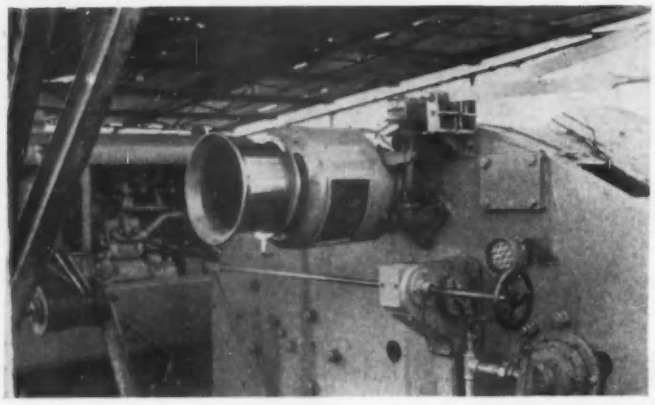


FIGURE 8—Keep cathead in good repair with a strong rope divider positioned ⅜-inch from spool. Operator—experienced man only.

FIGURE 9—Use catline grip to keep line taut and out of the way.

goes down into hole and the ice plug will shoot up the pipe presenting a hazard at the rig floor. This caused a fatality in Alberta last winter.

Cathead. (Figure 8) This is sometimes known as the hazardous helper, and that is what it really is. Be sure that the cathead rope-divider is not more than ⅜-inch from surface of cathead and that it is of strong material that will not bend out of shape during times of severe strain. Grooved catheads have caused many a rope to foul and in turn throw someone around a cathead or break their arm. Keep the cathead in excellent repair. There is no room on a catline for "green hands." Only an experienced motorman and the driller should use a catline. This will prove safer and more efficient.

Catlines. (Figures 9 & 10) Could a drilling rig operate without a catline? Of course not! At least not efficiently. Be sure the catline is large enough, 1½-inch in diameter or more. Small catlines are potential killers as they invariably are subjected to lifting more than they are designed to lift and that is when accidents happen. The catline should be kept secure when not in use through the use of a catline grip. This will also prevent the line from fouling on the kelly which can be very dangerous. Spools for extra rope are a must and should be kept off the floor.

Sand Drum Line Guide. (Figure 11) Line spoolers on sand drums will keep your men off the top of the drawworks. Some men have been known to station themselves on the drawworks to manually guide the sand line during some specific operation. This is careless practice as sand lines travel very fast, especially during swabbing operations. Crew members should keep away from moving sand lines as much as possible, particularly when running in to establish the fluid level while swabbing. The swab will strike the fluid, throwing slack into the line and causing a pile-up around the sand reel. As the swab drops through the fluid it takes up slack very quickly. If a man should get caught in this slack line, it could be fatal. Swabbing is a serious business—treat it that way and injuries will be avoided!

Tool Racks. (Figure 12) A well kept tool rack with "a place for everything and everything in its place" will pay off. Good housekeeping is the first rule of safety. Drilling tool racks on the rig floor will certainly cut down your "tripping" hazards. Hand tools lying around on the floor will add considerably to your maintenance costs over a period of time. The inefficiency of these tools through misuse will promote personal injuries.

Ladders. (Figure 13) A great many times motor radiators have been checked by the motor man who climbs up on the motor in order that he may see into the radiator. If he slips, a hand or finger can be severed by the fan blade. If you have large motors it is good practice to install ladders on the front side for easy access to the radiator.

Properly constructed ladders on the derrick are equally important. A frequent check of derrick ladders and safety landings that are attached to the ladders is prudent practice.

The comparatively new counterbalance attached to the derrick for the safe ascent and descent of the derrick man is recommended.

Blowout Preventers. (Figure 14) Blowout preventers are our last line of defense on a drilling rig. A daily test of B.O.P. equipment is a must and data regarding test should be recorded on the drilling report.

Pipe rams, full close rams and

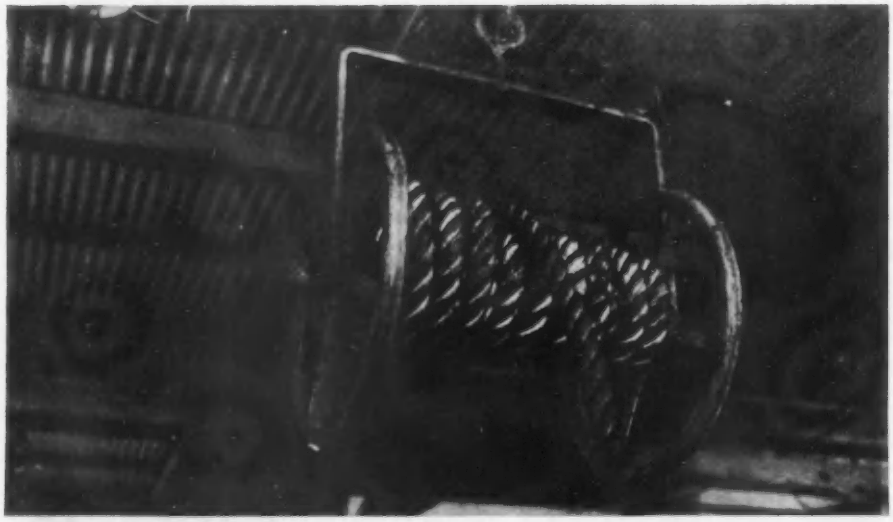


FIGURE 10—Use spool for extra catline to keep it off the floor.

Magcobar now provides an

EXCLUSIVE LOUISIANA OFFSHORE DIVISION . . .

. . . gives you FASTER, MORE SPECIALIZED MUD SERVICE

Magcobar now has mud engineers stationed in four strategic locations along the Louisana Gulf Coast whose only job is to service offshore rigs. These men are offshore specialists—they know your problems and how to solve them. On offshore locations, as on any location on the North American Continent, when you want the best mud products and the best mud service—Call MAGCOBAR.

MAGNET COVE BARIUM CORPORATION
Houston, Texas

Magcobar
Complete
DRILLING MUD SERVICE

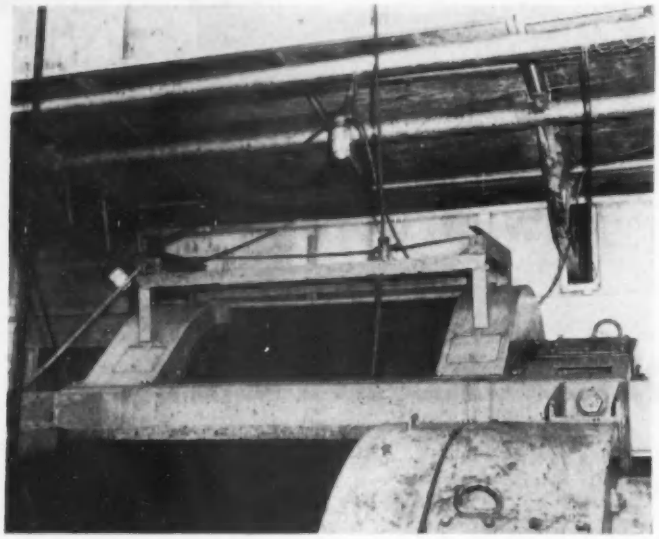


FIGURE 11—Line spoolers on sand drums will make it unnecessary for crewman to manually guide line during sandline operations.

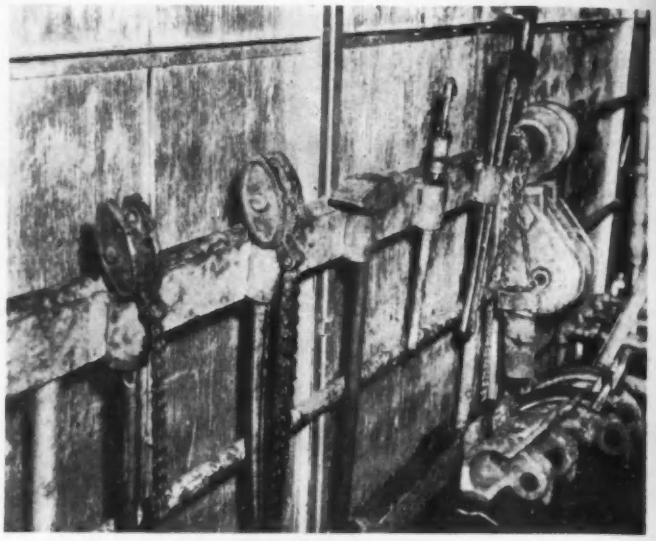


FIGURE 12—A well kept tool rack will prevent accidents and promote good housekeeping around the derrick floor.

FIGURE 13—Where large motors are being used, install ladders on front side for easy access to radiator.

other type B.O.P.s should be clearly marked on controls which should be located on or near the rig floor. Gages should be checked to insure that they are working correctly at all times. Remember, a B.O.P. that is not working properly is like drilling in an "open hole."

Line Cutting Hook. (Figure 15) This device is used to suspend travelling blocks in the derrick while taking the drilling line off the main drum in order to slip and cut the line. There are other methods that may be used equally as well, but this one has proved to be quite good. It is not good practice to improvise, such as clamping a large-diameter drilling line to the sand line and thus anchoring the travelling blocks until the line can be slipped or cut. This practice has cost lives in the past. Don't take chances; if in doubt, it is wise to lay the blocks down.

Tools to Be Used in Derrick. Members of the crew should not go above the derrick floor with tools such as hammers, screw drivers, bulbs and pliers in their pockets. If they carry equipment into the derrick, a tool-sack or tool-belt should be used. A small tool dropped from the top of the derrick or monkey board can kill or maim almost as quickly as a rifle bullet.

Mud Cans. This is one of the oldest safety devices in use and one that is being appreciated more every day. Water cans should be handy and

BIG CHIEF USES ELECTRO-MOTIVE POWER on first offshore rig

Big Chief Drilling Company of Oklahoma City was a landlubber for twenty years before plunging into offshore drilling. More than a year was spent studying offshore problems, designing equipment before launching Rig 34. Why they picked Electro-Motive Diesel-Electric Power is told here:

Deck cost cut to minimum

Platform deck area measures only 88 by 145 feet. Living quarters, fuel storage, mud, water, pipe racks, etc., alone take 88 by 110 feet. In the space left, (35x88) Big Chief's engineers had to pack a complete rig and provide for location of six wells. Solution: Electro-Motive Power with flexible cables permitted locating components in a space-saving three story design.

Big power, simple control

Two 875-hp GM Diesel engines driving four 500-kw dc generators supply power to 625-hp drive motors on mud pumps, rotary and draw works. Coupled with this power is a simple and accurate control system that provides smooth and rapid acceleration of loads with positive control of speed and torque. Result: flexible control for faster, lower cost drilling.

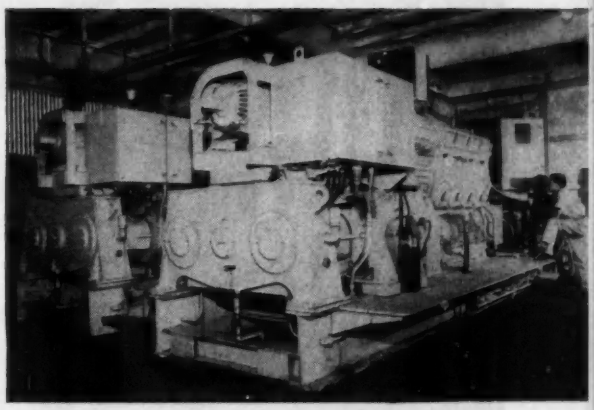
Matched components

Electro-Motive Power is a complete drilling power system. Each component was designed and built to work together—one manufacturer—one source of responsibility. The tested dependability and widespread acceptance of this power is proof of its drilling advantages on land or water. For your convenience there's an Electro-Motive Representative located in every major drilling area.

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS LA GRANGE, ILLINOIS

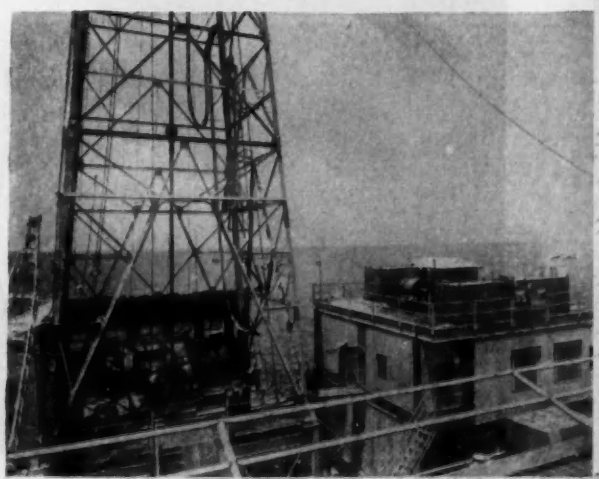
In Canada: General Motors Diesel Limited, London, Ontario

Petroleum industry sales offices: Tulsa, Oklahoma; Houston, Texas; Dallas, Texas; Morgan City, Louisiana; Pasadena, California.



Conveniently located in a shed beside the mast are the two 875-hp generating sets. Each drives two 500-kw dc generators and comes complete on skids with controls and cooling system. Note how cables to drive motors are neatly routed on overhead trays.

Two 625-hp dc drive motors supply power for draw works. Generators are connected to these motors through electric cables, permitting complete flexibility of arrangement. In fact, the entire Diesel-electric system can readily be adapted to any platform.



This view from the heliport which tops the crews quarters shows the simple and efficient layout of Rig 34. At left is the driller's stand, at right the engine generator shed. Below deck are pumps and tanks for mud, fuel and water.

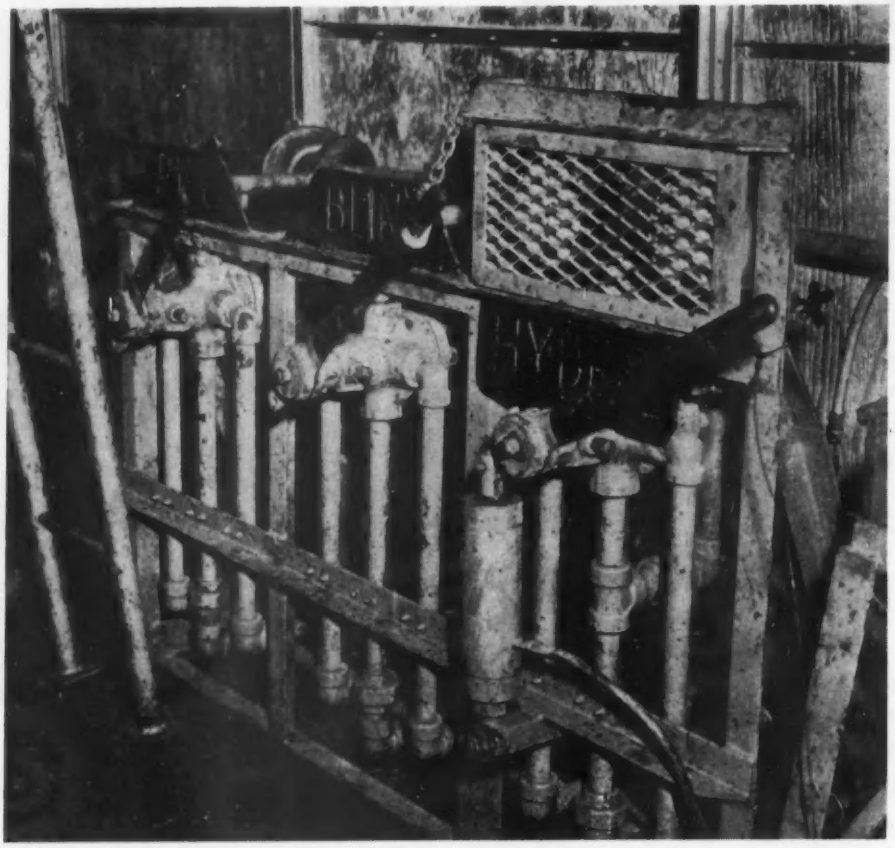


FIGURE 14—Blowout preventer equipment should be checked daily and data recorded on the drilling report.

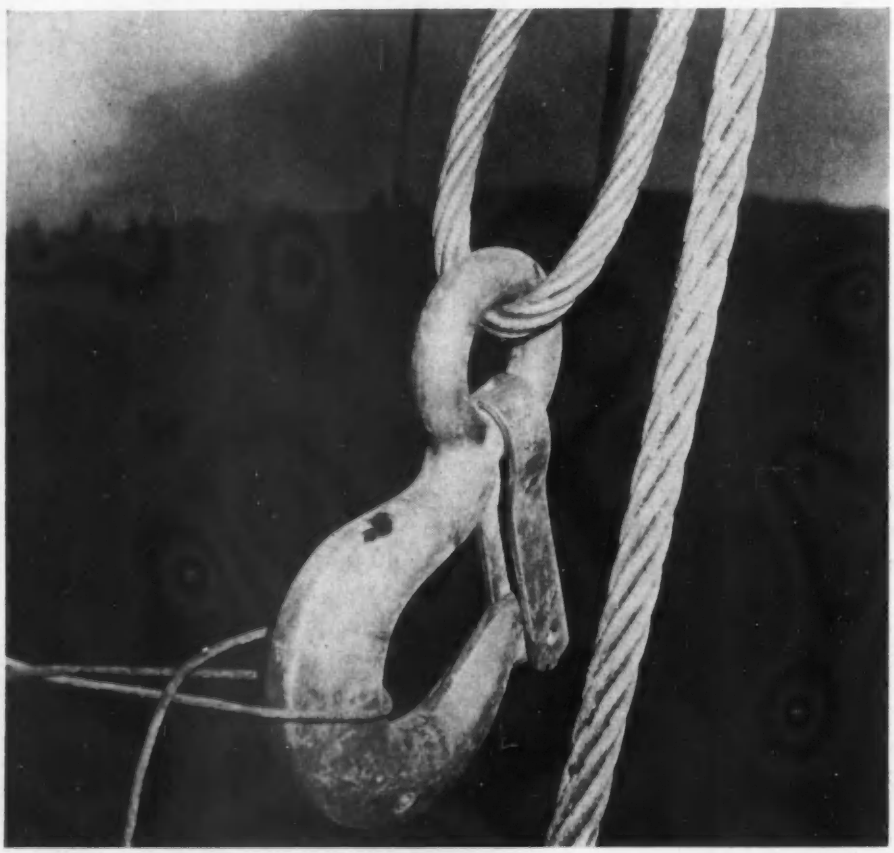


FIGURE 15—Use hook device to suspend traveling blocks in derrick while cutting off line.

About the Author

R. G. ARCHIBALD started working in the oil fields in 1940 shortly after completing school in Turner Valley, Alberta, Canada. In 1941 he joined the Royal Canadian Air Force and upon his discharge in 1945 returned to the oil fields to work in wildcat drilling operations throughout Alberta as a foreman and driller. In 1954 he entered the safety field with Arrow Drilling Co., Canada, Ltd., and in June, 1955, joined Shell Oil Company as a safety representative in the Calgary area.

full of fresh water so that crew members can douse each other and dilute the action of chemicals when they inadvertently get some in their eyes or on their skins.

With new drilling muds continually being developed and many more chemicals being used, crewmen must be very cautious. Do not splash mud any more than is necessary; eyes cannot be replaced!

Poisonous Gases. Poisonous gas has taken its toll in the oilfields; hydrogen sulphide being one of the worst offenders. Do not take chances with this gas as it is very poisonous. H_2S detectors, gas masks and a resuscitator should be at the wellsite. They should be handy for immediate use during drill stem testing and completion operations especially in areas where the presence of this deadly gas is a possibility.

It has been said that in knowledge there is strength. Everyone who is connected with drilling rigs should know that the right equipment for the job is available, and know how to use this equipment properly and safely. The rig floor can become a safe place to work.

ACKNOWLEDGMENT

The author thanks Shell Oil Company and Canadian Association of Oilwell Drilling Contractors for permission to publish this article which is based on a talk presented at a Drilling Safety Clinic, Banff, Canada.

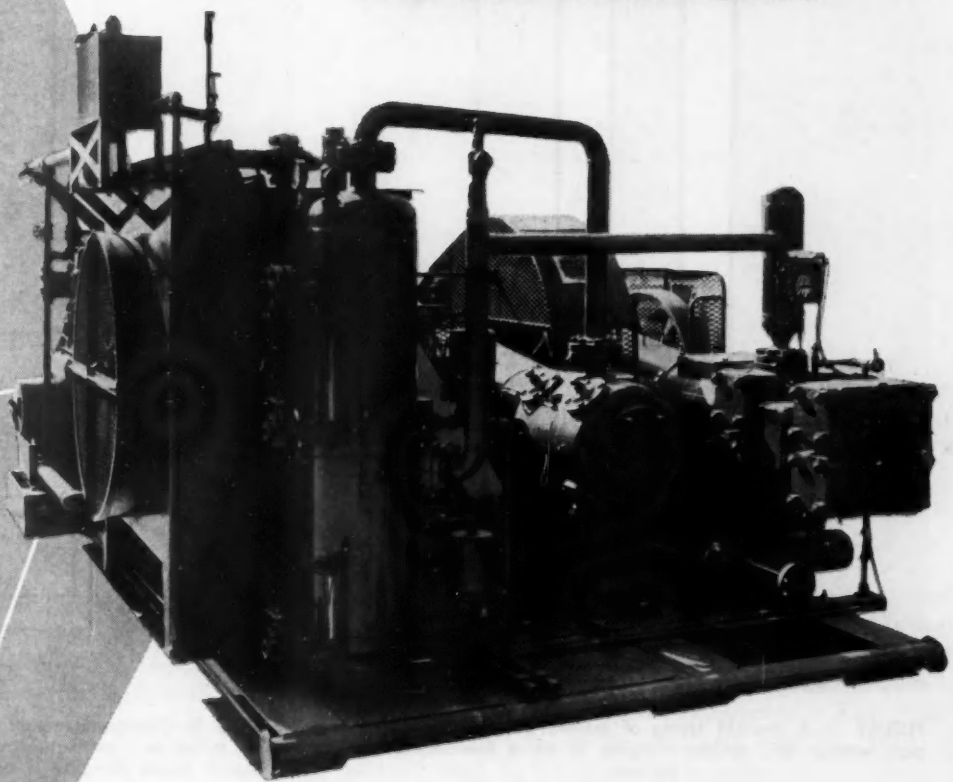
* COMPRESSIONEERING

Has made possible the outstanding economical, satisfactory and continuous performance of

WILSON SUPPLY

INGERSOLL-RAND
Packaged, Portable

COMPRESSORS



* The combination of proper engineering with skillful fabrication for every compressor installation.

COMPRESSOR DIVISION
P. O. Drawer 19

Branch Stores

TEXAS: Alice, Corpus Christi, Victoria, McAllen, Bay City, Columbus, Barbers Hill, Liberty, Beaumont, Kilgore, Odessa, San Antonio. LOUISIANA: Lake Charles, New Iberia, Houma, Harvey, Shreveport. NEW MEXICO: Hobbs.

Sales Offices

DALLAS, SHREVEPORT, SAN ANTONIO, TULSA, NEW ORLEANS, LAKE CHARLES, CORPUS CHRISTI, MIDLAND

WILSON SUPPLY CO
HOUSTON, TEXAS

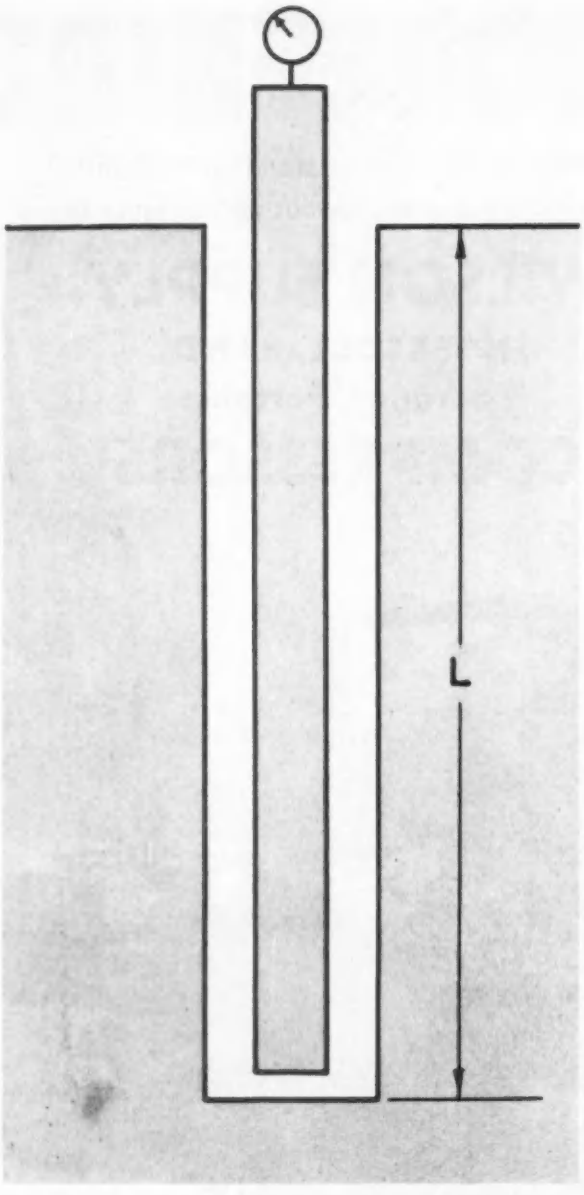


FIGURE 1—A straight string of internal-external flush drill pipe without drill collars hanging in air a few inches off bottom.

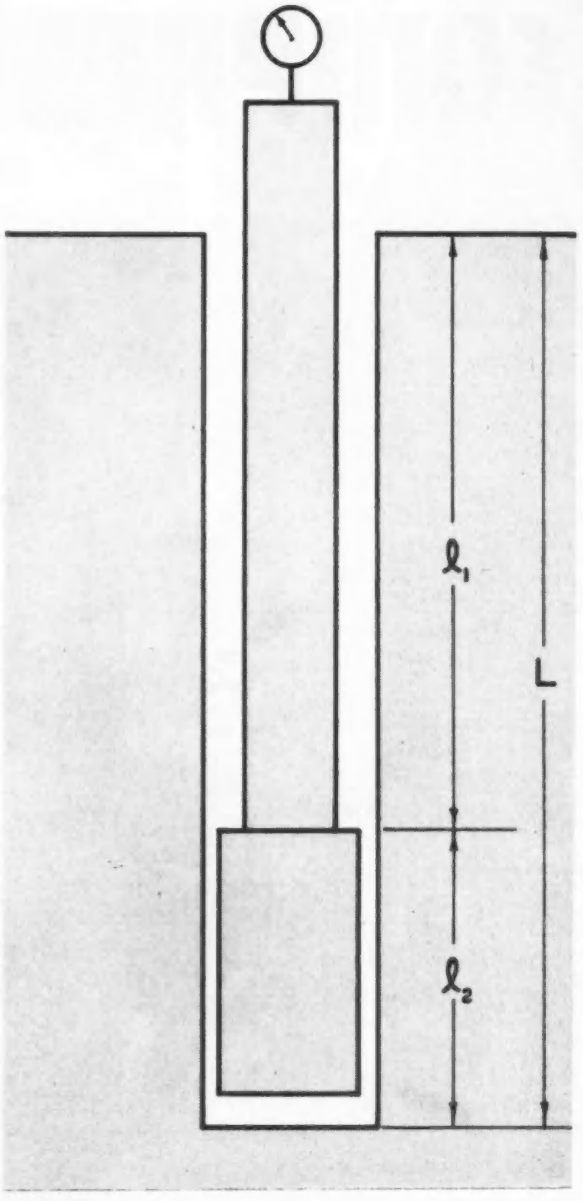


FIGURE 2—Change in section when an internal-external flush joint string in combination with a flush bore drill collar string of larger diameter is hanging in air a short distance off bottom.

Selecting Drill Collar Length By Pressure Method

Consideration is given to the buoyancy effect and the weight of the drilling fluid displaced when calculating the length of the drill collar string.

By D. M. BEST
Gulf Tool Company, Inc.
Houston

THE ACCEPTED PRACTICE, for years, has been to run heavy walled sections of pipe, called drill collars, at the lower end of the string. This practice, besides providing weight and stability, keeps the thinner walled portion of the drill string under tensile forces while drilling. It has been well demonstrated that when the thinner walled section is under compressive forces a bending effect is introduced. This is particularly accented at the ends nearest the connectors or tool joints. Such bending materially reduces the life of the pipe.

Because pipe life is greater when under tensile rather than compressive loading, drill collars are used. This causes the compressive and bending loads to occur in the heavier walled sections which are better able to withstand them.

The method used to calculate the required length of

drill collars for a given well has been as follows:

Given: Drill Pipe: 4-inch outside diameter, 15.7 pounds per foot
Drill Collars: 5¾-inch OD × 2¼-inch inside diameter, 75 pounds per foot
Mud weight: 15.0 pounds per gallon
Buoyancy Factor (B) = 0.771
Weight on Bit: 15,000 pounds
Safety Factor weight (W_s) = 5000 pounds
Depth: 10,000 feet

Find: Required length of drill collars (L_{dc}) needed to put 15,000 pounds at the bit with 5000-pound safety factor.

Solution: (Buoyancy Method)

Weight of drill collars in air (W_a) = L × Weight/foot of pipe
Weight of drill collars in hole = $W_a \times B = 15{,}000 + 5000 = 20{,}000$ pounds

$$\therefore L_{dc} = \frac{20{,}000}{75 \times 0.771} = 345 \text{ feet}$$

Now suppose the problem is solved from the very beginning using a completely different calculation principle (Pressure Method). Figure 1 is a drill string of internal, external flush pipe, no drill collars, and no fluid in the hole. The string of length L extends to within inches of the bottom of the hole, but is not touching bottom. Now the hanging load on the hook (W_H) is the same as the total weight in air (W_a) which is:

$$W_H = W_a = L \times \text{wt/ft of pipe}$$

The complete string is in tension beginning at zero on bottom and increasing upward to a maximum at the hook. If the string is lowered to bottom and the weight is slacked off, equal to W_B, then the hanging load on the hook equals:

$$W_H = W_a - W_B$$

This is the maximum tensile load in the string and it decreases downward to some depth $(L - l)$ at which it is zero. From there downward there is a compressive force increasing from zero at $(L - l)$ to a maximum of W_B on the lower end. Now, l, the length off bottom at which the load is zero, can be calculated as follows:

$$l = \frac{W_B}{\text{Wt./ft.}}$$

Next suppose the same drill string is introduced into a well containing any drilling fluid. It is known that any body immersed in any fluid is buoyed up by a *force* equal to the weight of the fluid displaced. In this case the load on the hook is

$$W_f = W_a - \text{Wt. of fluid displaced}$$

But the weight of the fluid displaced equals the pipe wall area (A_{pw}) multiplied by the length of pipe immersed (L_1) and the density of the fluid; and

$L_1 \times$ density = Pressure head (P_H) at lower end of drill string
$\therefore$ Wt. of fluid displaced = $A_{pw} \times P_H$

Then substituting:

$$W_f = W_a - (A_{pw} \times P_H)$$

Therefore it can be said that the hook load of any external, internal flush string in any fluid equals the weight of that string in air less the product of its wall area times the pressure head at the lower end of the string.

As noted before the maximum tension is at the hook and is equal to W_f. This decreases downward to some depth $(L - l)$ at which the load is zero. Below this there is compressive load beginning with zero at $(L - l)$ and ever increasing to the bottom. At this point it is a maximum and equals the pipe wall area multiplied by the bottom hole pressure. Further:

$$l = \frac{Apw \times P_H}{\text{Wt./Ft. in air}}$$

If this string is lowered until it sits on bottom with a force of W_B, the hook load is now:

$$W_H = W_f - W_B$$

and the same conditions exist as before, the only difference being quantity and l is greater by:

$$\frac{W_B}{\text{Wt./Ft. in air}}$$

Next consider the string shown in Figure 2 made up of internal, external flush pipe in combination with a flush bore but a larger OD drill collar string at the lower end.

In this case, the hook load in air:

$$W_a = [(\text{Wt./Ft. upper} \times l_1) + (\text{Wt./Ft. lower} \times l_2)]$$

and the complete string is in tension when hung just off bottom. If the string is lowered until W_B load is applied on bottom, the loads are as before; the tension load on the hook is decreased by W_B, there is a point of zero load, and from there downward is compressive load, that becomes maximum on bottom equal to W_B. The point of zero load, l_o, is calculated as before;

$$l_o = \frac{W_B}{\text{Wt./ft. of collars in air}}$$

This is true when W_B is less than the total weight of the drill collars.

When W_B is greater than the total drill collar weight then

$$l_o = l_2 + l_x \text{ and } l_x =$$

$$\text{and } l_x = \frac{W_B - \text{Wt of collars}}{\text{Wt/ft of drill string}}$$

Now, while hanging, introduce a drilling fluid in the well.

The hook load is now:

$W_f = W_a$ — Wt. fluid displaced
$= W_a$ — (Volume fluid displaced × wt/unit vol. fluid)
$= W_a$ — [(Wall area lower × L_1 × wt/unit vol. fluid) — (Area lower — area upper) ($L_1 - l_2$) (Wt./unit vol. fluid)]

But: $L_1 \times$ wt/unit vol. fluid = Pressure at L_1

And: $(L_1 - l_2)$ (Wt/unit vol. fluid) = Pressure at $(L_1 - l_2)$
$\therefore W_f = W_a$ — [(Wall area lower section × P_H) — (Δ $AP\Delta_A$)]

Where: ΔA = change in wall area upper to lower sections and

$P_{\Delta A}$ = Pressure at ΔA.

So again it can be seen that under these conditions of hanging in fluid the maximum tension is on the hook and the tension decreases to zero at some depth from bottom, l_o; and from there downward there is compression (due to static fluid) increasing to a maximum on the bottom equal to:

$$[(\text{Drill collar wall area} \times P_H) - \Delta AP_{\Delta A}.]$$

The point of zero load, when the weight of fluid displaced is less than the weight of the drill collars is:

$$l_o = \frac{(\text{Drill collar wall area} \times P_H) - (\Delta AP_{\Delta A})}{\text{Wt./ft. Collars in air}} \text{ Ft.}$$

When the weight of the fluid displaced is greater than the weight of the drill collars then:

$$l_o = l_2 + l_x \text{ and } l_x = \frac{\text{Wt. fluid displaced} - \text{Wt. of dc}}{\text{Wt./ft. of upper section}}$$

If the string just considered is lowered to bottom and a weight, W_B, is applied, the hook load is lowered by W_B and is

$$W_H = W_f - W_B, \qquad \text{a maximum}$$

and it decreases downward to zero at some point off bottom, l_o, at which point compression begins and increases downward to a maximum at the bottom,

$$C_{Max} = [(Acw \times P_H) - (\Delta AP_{\Delta A}) + W_B] \text{ Lbs.}$$

where A_{CW} = area drill collar wall.

So that the zero load plane may fall within the drill collar section l_o must be less than l_2. When $l_o = l_2$ the zero load plane is exactly at the top of the drill collar section.

Now, to find the required drill collar length L_2, by this "pressure method," equate l_2 to l_o plus the weight on bit, W_B and the desired safety factor, W_S, or:

$$l_2 = \left[\frac{(Acw \times P_H) - (\Delta AP_{\Delta A}) + (W_B) + (W_s)}{\text{Wt. drill collars/ft. in air}}\right] \text{Ft.}$$

and since $P_{\Delta A} = \left[P_H - \left(\frac{\text{Fluid Head}}{\text{Ft.}} \times l_2\right)\right]$ this is solvable.

Recalculating the original problem with this equation gives a required length of drill collars of 1346 feet. This shows a wide discrepancy between using the "buoyancy method" and the "pressure method." This discrepancy is greater as depths and fluid weights increase. To keep the length of collars to a feasible amount an inspection of the equation shows that decreasing the pipe area relative to the collar area greatly affects such lengths, and they can be kept to economical amounts.

There are now only two other factors to be considered;

1. Static effect of *non* internal, external flush connectors.

2. Dynamic effect (when pumps are running)

Under 1, it is believed that this has the effect only of lowering the "Effective" unit weight of the pipe per foot. In other words, the point of application of this upward force is "unitly spaced" throughout l_1, and therefore actually makes the pipe (per joint or per foot, however considered) weigh less than in air. Therefore no drill collar weight need be added to compensate for this upward force.

Under 2, the same reasoning is applicable. It could be said then that the stretch of pipe is lowered, considering OD changes; and lengthened considering ID changes by the fluid forces and no bottom effect is had. If the string materially lengthens, hook loading would have to be watched closely when starting the pumps off bottom (when working close to maximums). This would be immediately counteracted when bottom is reached and weight is slacked off. If such forces were still acting when drilling, it is possible that excessive collar length may be in the hole; but this would be an added safety factor.

If the string materially shortens then more Kelly would have to be slacked off to reach bottom. It is possible under these conditions to need more collars to counteract this force if it prevails not only off bottom but while on bottom drilling.

However, it is believed these forces are, though variable, fairly balanced and whichever is greater by practice can be eliminated insofar as drill collar lengths are concerned.

CONCLUSIONS

1. Any pipe hanging in air is in tension its full length, from maximum at top to minimum (0) at bottom.

2. Any pipe hanging in fluid has maximum tension at top decreasing to zero at some intermediate point, at which point compression begins and this compression increases to a maximum at bottom.

3. The zero point in 2 above is at the same level for any pipe size if fluid unit weight is constant.

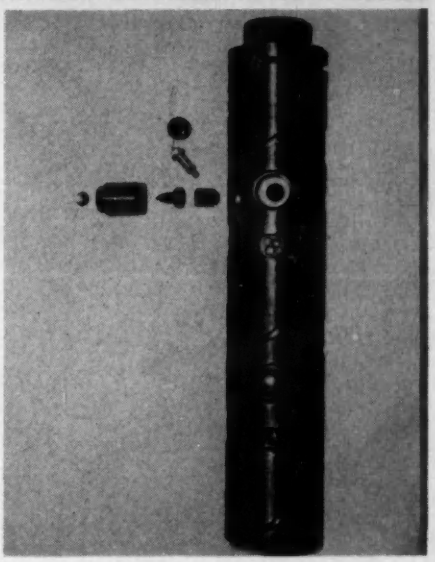
4. This zero point cannot be set within the collar section by assuming a plain pipe section, finding the zero point and then adding drill collar weight to pull it down.

5. This zero point cannot be set within the collar section by using the weight on bit modified by the buoyancy factor.

6. This zero point is easily calculated once the pipe size, drill collar size, fluid weight, and depth of hole have been decided upon.

7. If the length of drill collars required is too great economically or physically, the pipe diameter can be reduced, the drill collar diameter can be increased, or both, to *materially* affect the length required.

8. It is not believed that the tool joint OD and/or ID or bits affect the zero plane stress point materially either statically or dynamically. If such does occur dynamically, it can easily be corrected by adding or removing drill collar sections as required. —**The End**



Answers to Your Question . . .

Should We Use Bullets or Jets?

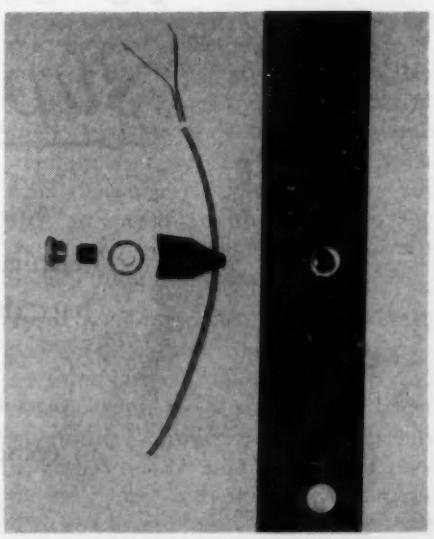
Operators have two effective perforating tools at their disposal in bullet guns and jet charges. It is important to choose the proper one for a job. How do you make the choice?

By JAKE LEBUS
Perforating Guns Atlas Corporation
Houston

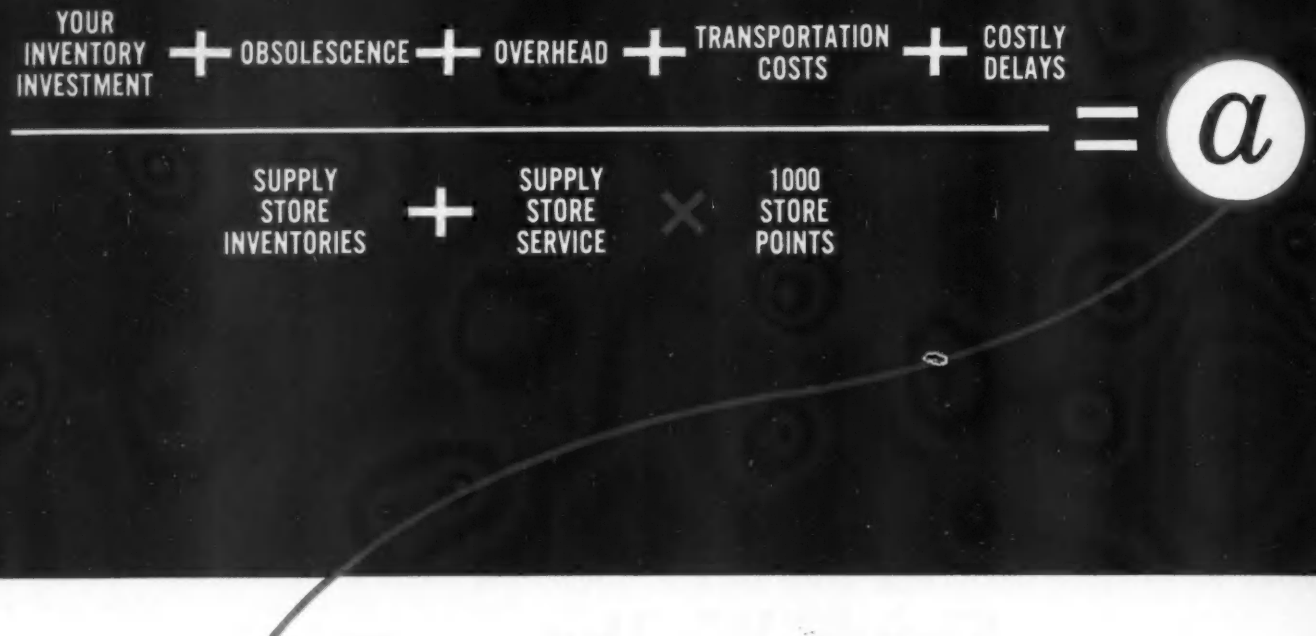
BOTH BULLETS and jets have undergone considerable improvement since their introduction into the oil field. Service companies, manufacturers, universities, research centers, oil producers and many other groups have contributed and are still contributing to this advancement. As a result it is not always easy for the operator to keep abreast of all this activity and use it to best advantage in reaching a decision for his operation.

Since the advent of jet perforating there has been much controversy over the merits of jets and bullets for perforating well casing. Too often, the fact they they are both effective tools for specific application is overlooked. There are situations where jets will do a superior perforating job and conversely there are circumstances that a bullet can cope with best. To assure maximum effectiveness from a specific perforating job a number of factors should be considered.

Important Factors. Among these factors are—resistance of the perforated media (casing, cement and formation), type of producing formation, final treatment intended for well completion, well temperature at the shooting zone, casing size, fracturing effect desired and the ever present economics. These are some of the



The photo at the top is a four-inch bullet gun. Where formations are soft or economics is a consideration, it is superior to the jet. It has a tendency to fracture hard formations and can be selectively fired to provide any desired shot density. The lower photo is a four-inch jet gun. In hard formations or shooting through multiple strings of casing set in hard cement, it has no equal. It will operate effectively at temperatures well above the 275-degree limit suggested for the bullet gun.



a sound reason to support your supply industry

Nothing is going to solve all your problems, but the Petroleum Industry should remain aware of the important part the Supply Industry plays in its day-to-day activities. The Supply Industry's operating profit is just a fraction of the savings it effects for you. It has earned the complete support of all of us.

LARKIN PACKER COMPANY, INC.
WAXAHACHIE, TEXAS

LARKIN
...Through Your Supply Store

PESA
PARTNERS IN PETROLEUM PROGRESS

LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

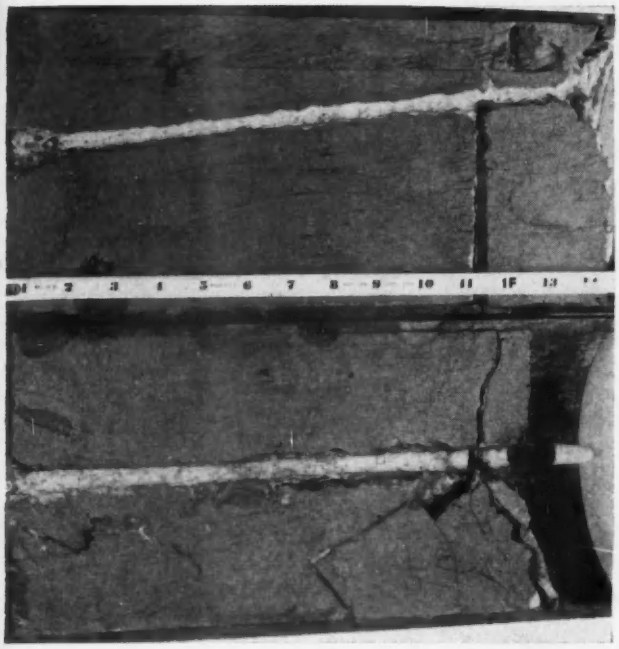


FIGURE 1—In 24-hour cured cement targets, simulating a very soft formation, both the jet (top) and the bullet shot completely through the targets.

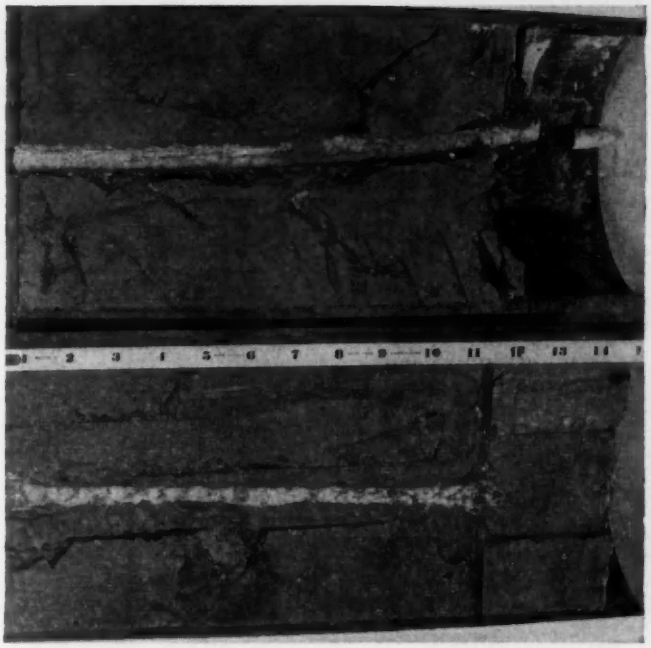


FIGURE 2—In 72-hour cured cement targets, simulating a medium-soft to medium formation, the bullet (top) shot completely through its target while the jet penetrated only to 11⅞ inches.

things which determine penetration depth, fracturing effect, number of holes required per foot and whether or not a bullet gun or a jet charge will be most effective.

Temperatures. Where well temperature at the shooting zone is in excess of 275° F. it is best to use a jet perforator. One characteristic common to all types of propellant powders used in the bullet perforator is an inherent instability at high temperatures. Over-exposure to high temperatures causes a decomposition which may result in premature ignition with the attendant danger of perforating a well out-of-zone.

This characteristic is also present in the explosive used in jet perforators. It occurs, however, at much higher temperatures. For this reason the jet should certainly be selected where temperatures in the shooting zone exceed 275° F.

Casing Size. Another factor which might dictate the type of perforator is the size of the casing in which the gun must be run. As a general rule, the gun should be as large as possible, consistent with adequate clearance for fluid bypass through the casing. Adequate clearance must be allowed around the gun for the passage of debris from previous operations or from the perforator itself. If possible, the perforating gun should be at least ½-inch smaller in diameter than the inside diameter of the casing.

The efficiency of the jet perforator is not affected nearly as much as that of the bullet gun by a reduction in diameter. As a result there are 1¾-inch diameter jet guns with remarkable penetrating power. This property is largely responsible for the success of the permanent-type well completion technique.

Where wells are to be completed in 4½-inch O.D. or smaller liners the jet gun is decidedly superior to the bullet.

Fracturing. In addition to the very important factor of penetration there is another consideration of almost equal importance that must be taken into account in comparing bullets and jets. This item is the fracturing effect of the perforation on the formation.

A study was made of the results of bullet and jet shots in hundreds of different types of targets under various conditions. It shows very definitely that bullets cause considerably more fracturing of the formation than do jets. This effect, combined with a uniformly larger diameter hole obtained with a bullet perforator, accounts for the preference of the bullet gun where the well is to be subjected to a fracturing treatment after perforating.

Economics. Frequently overlooked in the selection of the bullet or jet gun for perforating is the important question of economics for a particular perforating job. Here the bullet gun has a distinct advantage offering the operator a substantial reduction in cost. This saving may be the result of any one or all of three factors. First, the bullet price per shot is cheaper than the jet. Second, the bullet gun carries more shots per run than the jet, hence fewer runs are required to cover a large zone with the same number of shots per foot. Third is the extreme flexibility of the bullet gun in providing complete selectivity of firing.

With the bullet gun, it is possible to shoot several different zones, or to shoot variable shot densities in one or more zones on one trip in the well. Shot densities of 2, 4, or 6 shots per foot are possible without moving the gun, and by moving the gun, this density may be increased as desired.

Type of Formation. When a comparison is made of the depth of penetration between bullets and jets the first question is—what are you shooting into? Considerable emphasis has been put on the performance of perforators fired into mild steel targets. The resulting picture is not very realistic since the hardness of the target is not representative of anything even remotely approaching an actual producing formation. In addition to showing actual comparative penetration of bullets and jets in targets of varying hardness, it appears logical that some effort should be expended

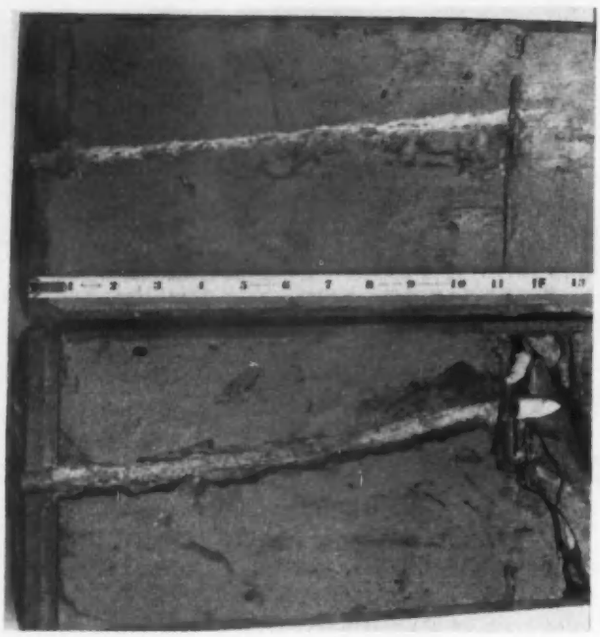


FIGURE 3—In five-day neat cement targets, the bullet (bottom) penetrated 12⅞ inches and the jet 11 3/16 inches. These targets simulate a medium-hard formation with bullet and jet penetrating approximately the same depths.

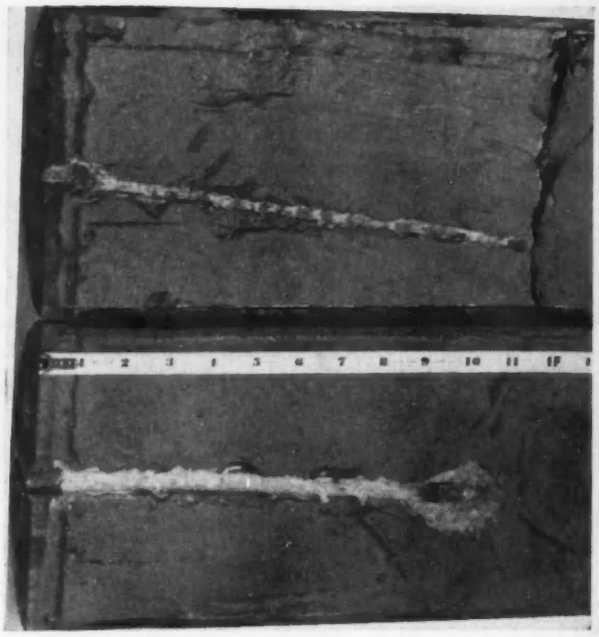


FIGURE 4—In seven-day neat cement targets, simulating a medium-hard to hard formation, the jet (top) penetrated 11-3/16 inches as compared to 10½ inches by the bullet.

to compare the target hardness to that of actual producing formations.

Test Data. To offer an indication of the results of comparing jets and bullets in a series of targets of varying hardness, comparable to actual formations, the following tests were run.

A comparison of the penetration achieved with a standard commercial 4-inch bullet gun and a conventional 4-inch jet gun was attempted. A group of targets were made by welding a ⅜-inch mild-steel plate to the end of a 6-inch pipe 15 inches long. Reinforcing rods were placed in the pipe approximately one foot from the face of the target to contain the cement near the end of the target. These targets were then filled with a 16-pound-per-gallon neat cement slurry. Precautions were taken to insure a dense homogenous target. These targets were then allowed to cure from 1 to 10 days before shooting.

At the end of 24 hours, two targets were taken from the group and shot with the bullet and jet gun. Figure 1 shows the comparison of the bullet and jet gun in these targets with neat cement aged 24 hours. Both the bullet and jet gun shot completely through the target. This target, with cement aged only 24 hours would simulate a very soft formation.

The test was repeated by the same guns into targets after the cement had cured 48 hours. In this test also, both the bullet and jet passed completely through the target. This target, with cement aged 48 hours would simulate a soft formation.

About the Author

JAKE H. LEBUS was the third employe hired by Perforating Guns Atlas Corporation in 1946 as a design engineer. Since that time, he has advanced to manager of engineering, where he is in charge of the designing, engineering and building of the company's field service and auxiliary equipment. After receiving his B.S. in mechanical engineering from Texas A. & M. College in 1942, LeBus did design and development work on naval underwater ordnance at the Naval Ordnance Laboratory, Washington, D. C. He later spent two years as design engineer at Sheffield Steel Corporation's Houston plant.

Figure 2 shows the comparison in neat cement aged 72 hours. In a target of this hardness the bullet very definitely out-penetrated the jet. The bullet gun again shot completely through the target, while the jet charge had a total penetration of 11⅞ inches. This target would simulate a normal cement sheath around the casing surrounded by a medium-soft to a medium formation.

Figure 3 shows the comparison between the bullet and jet into the same type of target with neat cement aged five days. At this point the hardness of the target was such that the penetration of bullet and jet was approximately equal. In these targets the jet gun gave an average penetration of 12 3/16 inches and the bullet gun a penetration of 12⅞ inches. This target would simulate an average cement sheath surrounded by a medium-hard formation.

Figure 4 shows the comparison of the bullet and jet in targets with neat cement aged seven days. Here the penetration of the jet has surpassed slightly the penetration of the bullet; the jet showing a penetration of 11 3/16 inches as compared to 10½ inches for the bullet. This target would simulate a medium-hard to hard formation.

Figure 5 shows the comparison of the jet and bullet in targets of neat cement aged ten days. In these targets, the jet gun had a penetration of 10½

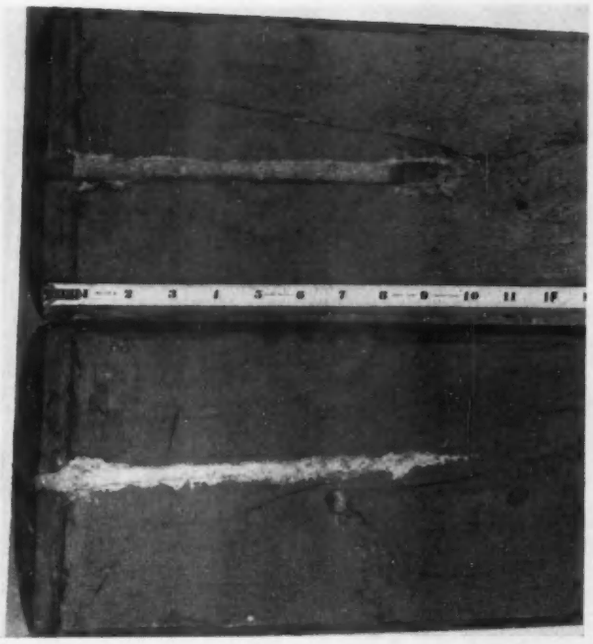


FIGURE 5—In 10-day neat cement targets, simulating a hard formation, the jet (bottom) penetrated 10½ inches as compared to 9⅜ inches by the bullet.

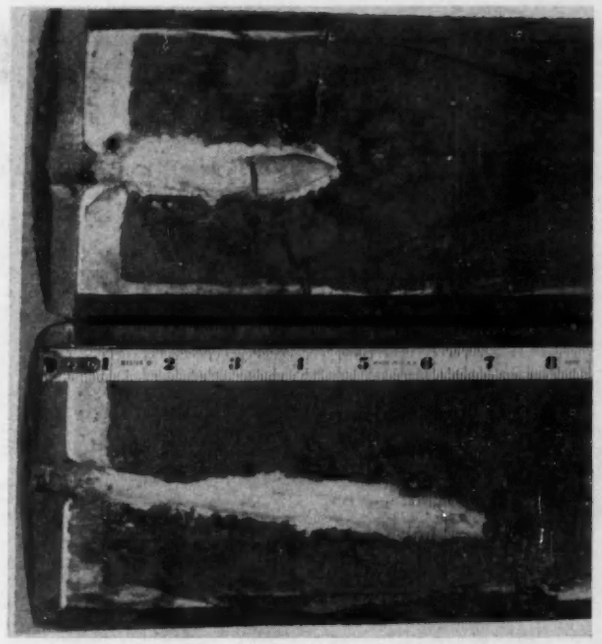


FIGURE 6—In exceptionally dense and hard Berea Sandstone targets, the bullet (top) penetrated a total depth of over four inches and the jet 6¾ inches.

inches as compared to 9⅜ inches for the bullet gun. Neat cement of this age would simulate a hard formation.

Classification of the hardnesses of these targets, as related to actual producing formations, is based on a study of results of actual coring jobs using a standard percussion type side wall sample taker. When the targets used in the penetration tests were made a similar group were prepared without the steel face plate. These targets were shot with the sample taker under simulated well conditions using an optimum standoff to obtain the longest core possible for each age cement. Samples were taken from targets identical in age and material to those perforated. By comparing the length of cores, obtained from these targets with the length of cores taken from various producing formations in different areas, it was possible to determine with a reasonable degree of accuracy how these cement targets compare with actual formations.

For example, in the ten-day neat cement a very short core was obtained with a sidewall sampler when it is shot into under optimum conditions.

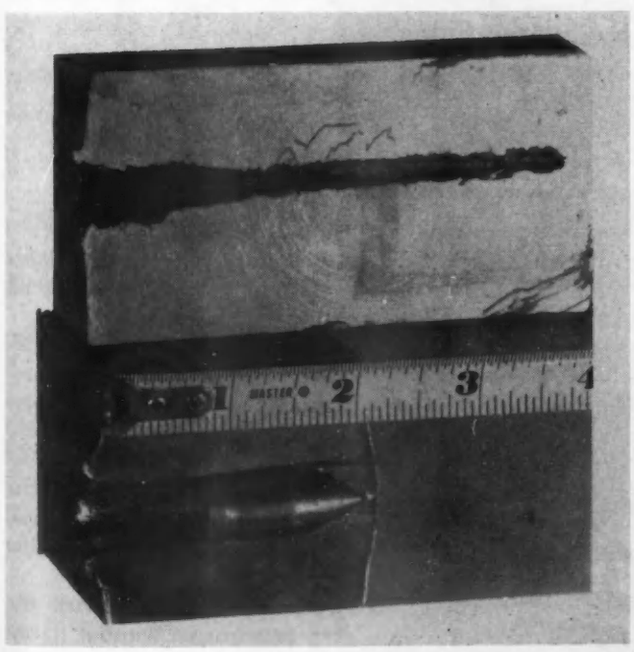


FIGURE 7—In mild-steel bar-plate targets, which far exceed the hardness of any formation, the jet (top) penetrated 3⅞ inches and the bullet penetrated two inches. Evaluating the effectiveness of a bullet versus a jet in steel is of no value to an operator as a review will disclose.

On the other hand, almost full length cores were obtained with a sidewall sampler in the neat cement targets aged 3 and 5 days. By comparing these cores with those obtained from actual producing formations in the Gulf Coast and Louisiana, we are able to classify these cement targets as simulating a medium-soft to medium-hard formation.

Based upon results obtained with the sample taker a study of the comparative tests shown in Figures 1 through 5 lead to a very definite conclusion. In any formation from which cores can be obtained with a side wall sampler, the bullet gun gives as good penetration as the jet charge and even better penetration in the softer formations.

Figure 6 and 7 illustrate the superiority of jets over bullets under certain conditions.

Figure 6 provides a comparison in a target of ⅜-inch mild steel plate backed by ¾-inch of hydromite and a well confined small diameter Berea sandstone core. This Berea sandstone is an extremely dense and hard formation and an exceedingly difficult target for the bullet gun when confined in this small diameter. Under these conditions the bullet gun penetrates a total of slightly less than 4¼ inches, while the jet gun has a penetration of 6¾ inches.

It is interesting to note that under certain simulated well conditions, us-

Continued on Page 158

Wells in the Leduc and Redwater fields of Canada have responded well to the use of a retarded acid designed to increase drainage area by providing maximum penetration depth in the formation.

Retarded Acid Is Successful in Alberta

Acidizing treatments using a newly developed etching or retarded acid have been used effectively in Canada's Leduc and Redwater fields.

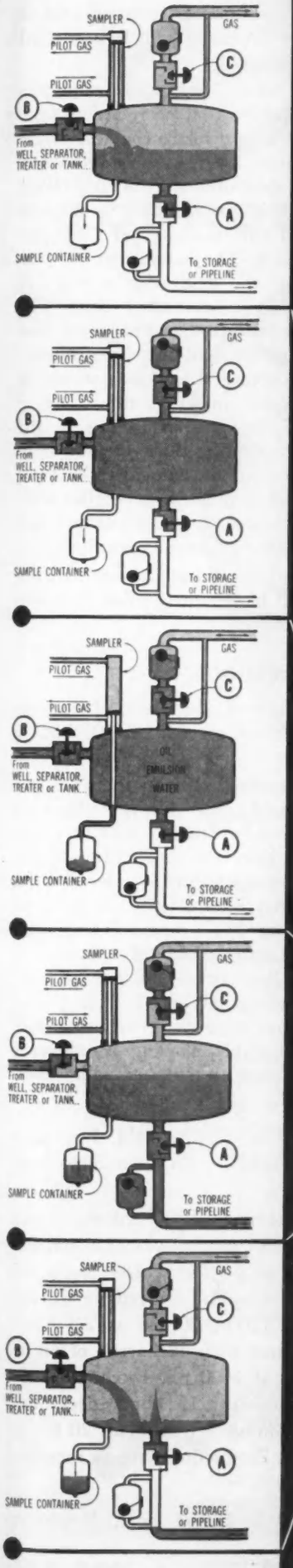
By HARRY R. GRYZEN
Dowell Incorporated
Edmonton, Alberta, Canada

THE INCREASED permeability obtained by ordinary acidizing treatments in limestone and dolomite formations is often limited to an area near the well bore. This happens because the acid spends itself quickly upon contact with the formation, and therefore cannot react in the formation farther back from the well bore. This problem has been solved by using a special retarded acid which provides deeper penetration and thus greater drainage area.

Various chemical additives have been used to slow down the reaction rate of acid. One of these is sulfuric acid. When sulfuric acid contacts calcareous rock, it reacts to form calcium sulfate, which is insoluble in water and only slightly soluble in acid. This compound forms a protective coating on the faces of drainage channels, thus allowing the live acid to penetrate farther from the well bore. However, it is likely that some of the sulfate formed will be carried in suspension until the acid is neutralized or has stopped moving. Although a protective coating is formed, a large quantity of plugging material may remain within the formation.

Furfural, furoic acid, and fural alcohol have also been used as retarding compounds. These are surface-active compounds which are supposed to coat the surface of the rock, thereby delaying the action of the acid. These materials are not as economical or effective as other materials that have been developed.

The retarded acid now in use obtains deep penetration without harm-



the new

"POSITIVE VOLUME METER"

WITH CORE BARREL SAMPLER

Patent applied for

FOR POSITIVE MEASUREMENT OF LIQUID FROM WELL, SEPARATOR, TREATER OR TANK

The PVM* meter is liquid packed, sampled, and then counted as the liquid is discharged. Its accuracy is indisputable as to volume of liquid measured at the pressure-temperature condition of operation.

A very unique feature is the automatic sampling of each cycle which takes out a core and saves it in a separate container attached so that exact content of BS&W can be determined later.

The PVM may be calibrated for an exact volume with compensation made for a given oil composition, temperature, and pressure.

The PVM Meter with Sampler is the most important development in oil field liquid metering yet offered.

The Core Barrel Sampler* used in conjunction with the PVM completes the requirements for metering oil field liquids. The Sampler cuts a core vertically through the liquid and deposits same in a container. Thus an exact and representative core is taken from a fixed volume. The composite sample when analyzed will give the true percentage of oil, water and/or emulsion that has been metered.

**PVM and Core Barrel Sampler are the trademarks of National Tank Company*

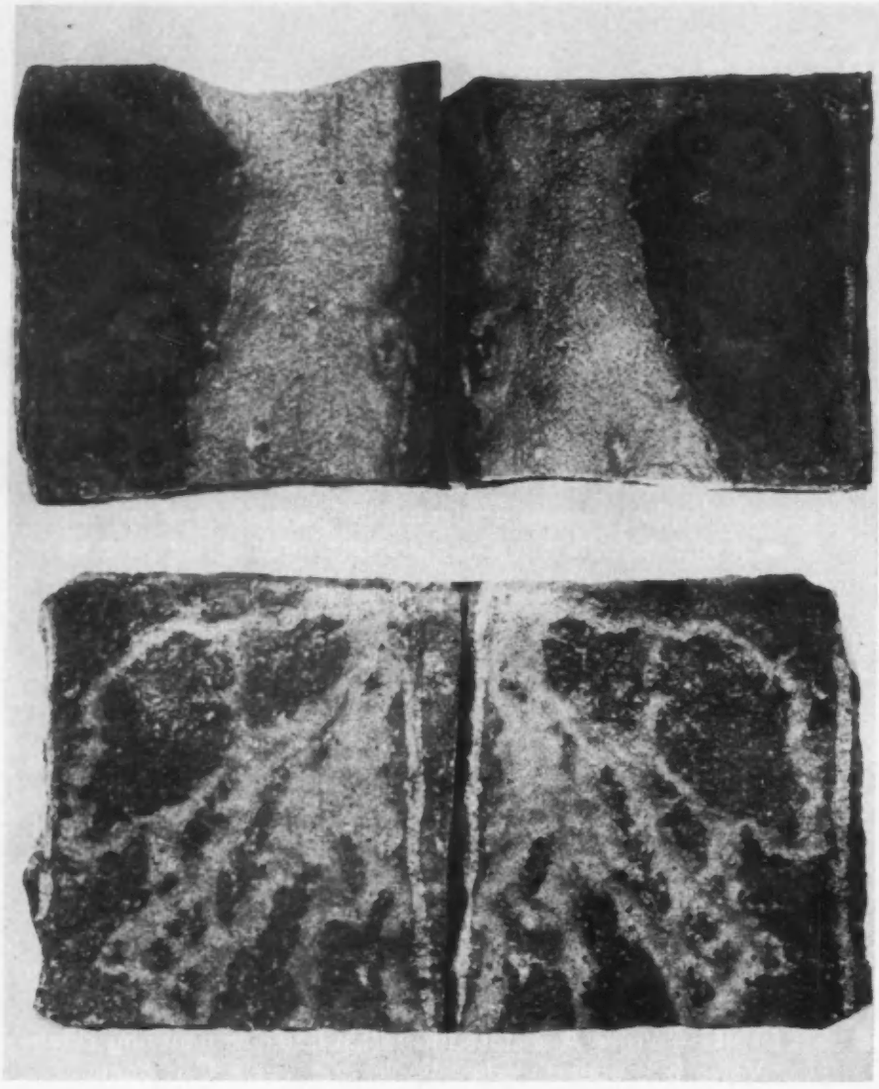
- **FILLING** — Valve **A** is closed to retain liquid in metering chamber. Valve **B** is open to admit liquid and Valve **C** is open. The Sample Barrel is up out of the stream.
- **POSITIVE VOLUME ISOLATION** — Valve **A** is still closed; meter fills past Valve **C** which closes. Valve **B** closes, assuring meter to be full of liquid. Note the volume trapped by Valves **A**, **B** and **C** is positive and not affected by float control levels.
- **CORE BARREL SAMPLING OF LIQUID** — Valves **A**, **B** and **C** are closed. Sample tube is driven vertically through the liquid, assuring a representative, proportional sample of the entire content as it exists in the vessel. Sample is discharged to a container for future analysis. Sampler is retracted.
- **DISCHARGING AND RECORDING** — Valve **A** now opens permitting vessel to empty the positive volume. The cycle counter is actuated. Valves **B** and **C** are still closed.
- **VALVES REPOSITION** — Valve **A** closes; Valve **C** is opened, dropping fluid into meter for measurement with next volume and Valve **B** opens for new cycle.

Write for Tank Topics on Metering Equipment

It's National

NATIONAL TANK COMPANY

TULSA, OKLAHOMA



This photograph compares the action of regular inhibited acid (top) and retarded acid. Shown are three-inch cores which were split, then propped apart by two small wires. A mud filter cake was applied to this artificial fracture under 200 psi. The two acids were then pumped through. The retarded acid's pattern of reaction showed that deeper penetration was being obtained with it than with the regular acid and that it removed the mud cake more effectively.

ing the formation. This acid, when first exposed to limestone, reacts almost as rapidly as regular acid. During its reaction, a thin organic film is laid down on the formation. This temporary film sharply decreases the reaction rate of the acid on those parts of the formation which have already been contacted. However, the acid can continue to react rapidly on new portions of the formation. This acid has proved to be very effective in penetrating deeply into fractured or heterogeneous porosity.

This organic film, which covers the walls of vugs or fractures, breaks down following the treatment so that oil can pass freely from formation pores into flow channels to the well bore. Thus the film does not interfere with later oil production in any way.

Retarded acid contains a silicate-control agent that coats silicate particles with a water-repellent film which prevents them from absorbing additional water. The effect of this agent is to reduce the swelling of silicate particles found in the formation. It also acts to reduce the size of silicate particles which have filtered into the formation from drilling mud.

In some acidizing treatments in which this agent was used, quantities of drilling mud have actually been returned with the spent acid in the formation. This indicates that drilling mud particles which had filtered into the formation were reduced in size by the silicate control agent and carried out of the formation in suspension in the spent acid. This action makes it possible for retarded acid to penetrate fractures which are filled with drilling mud.

There are three major techniques for the application of retarded acid. The first is to displace the acid to the perforations, squeeze it into the formation, then follow it with a large overflush. This overflush is usually about 25 barrels of oil per 1000 gallons of acid. The second method is to spearhead the acid with a wash of mud acid or intensified acid. The spearhead is introduced at a very slow rate, about one half barrel per minute, then the retarded acid is squeezed in at a normal injection rate. This is followed by an overflush, as in the first method. The third method is to displace the retarded acid to be used, followed by a quantity of regular acid. Both are squeezed at a rapid rate and followed by the normal overflush.

Typical results and applications are described briefly in the case histories which follow.

Case Histories

• **Well 1**—Leduc field, Devonian D-2; perforation 5431-5440 feet, 4 per foot.

Treatment: 1300 gallons of retarded acid. Acid displaced through tubing into annulus until tubing cleared, then squeezed through annulus. Pressures during squeeze: 1400 pounds per square inch, dropping to 800 psi at 2½-4 bpm. Overflushed with 5 barrels of oil at 4 bpm and 800 psi. Production before treatment: 10 barrels of oil per day on pump. Production after treatment: maximum allowable, flowing. Production after six months: maximum allowable, flowing.

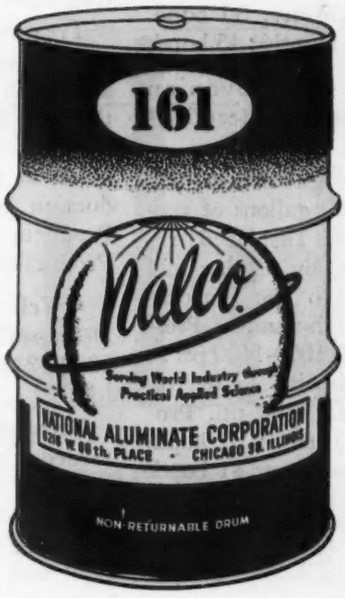
• **Well 2**—Leduc field, Devonian D-2; perforation 5205 feet-5234 feet, 4 per foot.

Treatment: 2000 gallons of retarded acid. Acid displaced down the annulus to perforations; squeezed through annulus. Pressures during squeeze: 1200-1600 psi at 2.3 bpm. Overflushed with 48 barrels of oil at 2.3 bpm at 1600 psi. Production before treatment: 15 bopd, declining. Production after treatment: 20 bopd, constant. Production after six months: 25 bopd.

• **Well 3**—Leduc field, Devonian

Streamlining

CORROSION CONTROL SERVICES



. . . for oil production and refining

Nalco and Visco corrosion control chemicals and service have set a standard for the oil production and refining industries. The program we are starting in 1957 offers still greater benefits to our oil industry customers.

Beginning now!

VISCO will specialize in producing well corrosion control chemicals.
NALCO will specialize in refinery corrosion control chemicals, and water flood and disposal treatment.

This emphasis on specialized service means that each Nalco or Visco Field Service Man has additional proven products to offer his customers. It means that his accounts will get full advantage of the research and development work, and the experience, of both companies. It means a more unified, concentrated approach to sales and service that will benefit the valued customers of both Nalco and Visco.

VISCO PRODUCTS COMPANY
A Unit of National Aluminate Corporation
2600 Nottingham at Kirby
Houston 5, Texas

NATIONAL ALUMINATE CORPORATION
6216 West 66th Place
Chicago 38, Illinois

BRANCHES AND AFFILIATES IN CANADA, SPAIN, ITALY AND WEST GERMANY

Visco® . . . FOR PRODUCING WELL CORROSION CONTROL

Nalco® . . . FOR REFINERY CORROSION CONTROL

For more data on advertised products, use Readers' Service Cards, last page.

D-2; perforations 5265-5273 feet, 4 per foot.

Treatment: 2000 gallons of retarded acid and 1000 gallons of regular inhibited acid. Displaced retarded acid, followed by regular acid down the annulus to the perforations; squeezed through annulus. Pressures during squeeze: 1000-1550 psi at 3½ bpm. Overflushed with 45 barrels of oil at 1600 psi at 3½ bpm. Production before treatment: 10 bopd. Production after treatment: 30 bopd. Production after six months: 45 bopd.

• **Well 4**—Leduc field, Devonian D-2; perforations from 5171 feet-5184 feet, 5220-5226 feet, 4 per foot.

Treatment: 1000 gallons of retarded acid and 1000 gallons of regular inhibited acid. Displaced retarded acid, followed by regular acid down the annulus to the perforations; squeezed through annulus. Pressures during squeeze: 1000-1400 psi at 2 bpm. Overflushed with 15 barrels of oil at 2 bpm and 1450 psi. Production before treatment: 7 bopd. Production after treatment: 41 bopd. Production after six months: 56 bopd.

• **Well 5**—Leduc field, Devonian D-2; perforations 4853-4898 feet, 4 per foot.

Treatment: 3000 gallons of retarded acid. Displaced acid to perforations through tubing; squeezed through tubing. Pressures during squeeze: 1800-1100 psi at 1.75 bpm. Overflushed with 49 barrels of oil, 2300 psi at 1.2 bpm. Production before treatment: 12 bopd. Production after treatment: 24 bopd. Production after six months: 24 bopd.

• **Well 6**—Redwater field, Devonian D-3; perforations 3252-3257 feet, 4 per foot.

Treatment: 200 gallons of mud acid wash and 300 gallons of retarded acid. Displaced mud acid, followed by retarded acid, down the tubing. Washed all mud acid past the perforations at ¼ bpm at 300 psi. Squeezed retarded acid into the formation at 1200 psi at 0.6 bpm. No overflush. Production before treatment: 50 bopd. Production after treatment: 75 bopd. Production after six months: 65 bopd.

• **Well 7**—Redwater field, Devonian D-3; perforations 3277-3283 feet, 4 per foot.

Treatment: 500 gallons of retarded acid. Displaced acid down the annulus to the perforations. Squeezed through the annulus at 1300 psi at 1.75 bpm. Overflushed with 12 barrels of oil at 1.75 bpm, 1300 psi. Production before treatment: 12 bopd. Production after treatment: 32 bopd. Production after six months: 35 bopd.

• **Well 8**—Redwater field, Devonian D-3; perforations 3220-3240 feet, 4 per foot.

Treatment: 500 gallons of retarded acid. Displaced the acid down the annulus to the perforations. Squeezed through the annulus at 1100 psi at 1½ bpm. Overflushed with 20 barrels of oil at 1100 psi at 1½ bpm. Production before treatment: 45 bopd. Production after treatment: 75 bopd. Production after six months: 50 bopd.

• **Well 9**—Leduc field, Devonian D-2; perforations 5219-5226 feet, 5230-5233 feet; 5245-5249 feet, 4 per foot.

Treatment: 1000 gallons of retarded acid and 500 gallons of regular inhibited acid. Displaced the retarded acid, followed by the inhibited acid, down the annulus to the perforations. Squeezed through the annulus. Pressures during the squeeze: 1200-1400 psi at 1½ bpm. Overflushed with 12 barrels of oil at 1250 psi at 1½ bpm. Production before treatment: 31 bopd. Production after treatment: 50 bopd. Production after six months: 41 barrels (allowable).

• **Well 10**—Leduc field, Devonian D-2; perforations 5204-5216 feet; 5217-5224 feet; 5225-5232 feet; 5237-5244 feet; 5245-5250 feet; 4 per foot.

Treatment: 1,500 gallons of retarded acid. Displaced acid into the annulus through the tubing. Squeezed through the annulus, pressures during the squeeze: 1000-500 psi at 1½ bpm. Overflushed with 10 barrels of oil, 500 psi at 1½ bpm. Production before treatment: 16 bopd. Production after treatment: 41 bopd. Production after six months: 35 bopd.

All treatments with retarded acid in the Leduc and Redwater fields have proved very successful. It is interesting to note that Wells 1, 2, 3, 4, 5, 9, and 10 were not swabbed until the day after the treatment. No emulsion blocks were formed. This is important because immediate swabbing is not always possible. —**The End**

Use Bullets or Jets?

Continued from Page 153

ing a productivity method of testing the effectiveness of perforating, Allen and Worzel[1] report an average flow index through essentially the same perforations as those illustrated in Figure 6. The results are almost identical for the bullet and jet perforations. Similar results on similar tests were reported by Krueger.[2] From these reports it appears that even though the jet achieves much greater penetration than the bullet in this particular target, the effectiveness and productivity through the bullet perforation is as good as that of the jet.

Figure 7 shows the comparison of the bullet and jet gun into mild steel plate. Here the bullet gun has a total penetration of 2 inches, whereas the jet gun has a penetration of 3⅞ inches. However, as stated before, there is no producing formation approaching the hardness and density of this steel plate.

These tests indicate that where 2 or 3 strings of casing must be penetrated, where there is an exceedingly thick and well confined cement sheath in the annulus between the casing and bore hole, or where the formation to be exposed is very hard and dense, the jet charge will provide greater penetration than the bullet gun. However, where the penetration problem is not so severe, the bullet gun is capable of a comparable or superior job.

Conclusion. In the final analysis the operator is interested in putting the most "oil in the tank" at the lowest cost per barrel. In view of this, the operator who fails to consider all of the factors of a particular perforating job may be wasting a substantial amount of money. He may be paying the premium price for a jet gun when a less expensive bullet gun would be as effective or using a bullet gun where jet is needed. Bullets and jets are oil field tools developed for the use of the operator. Pick the right tool for the job and if questions arise engineers with reputable service companies are always available to offer assistance.

REFERENCES

[1] Allen, T. O., and Worzel, H. D.: Productivity Method of Evaluating Gun Perforating. Spring Meeting, Southwestern Division of Production, API, Dallas, March 21-22-23, 1956.

[2] Krueger, R. F.: Joint Bullet & Jet Perforation Tests. Spring Meeting, Pacific Coast District, Division of Production, API, Los Angeles, May 10-11, 1956.

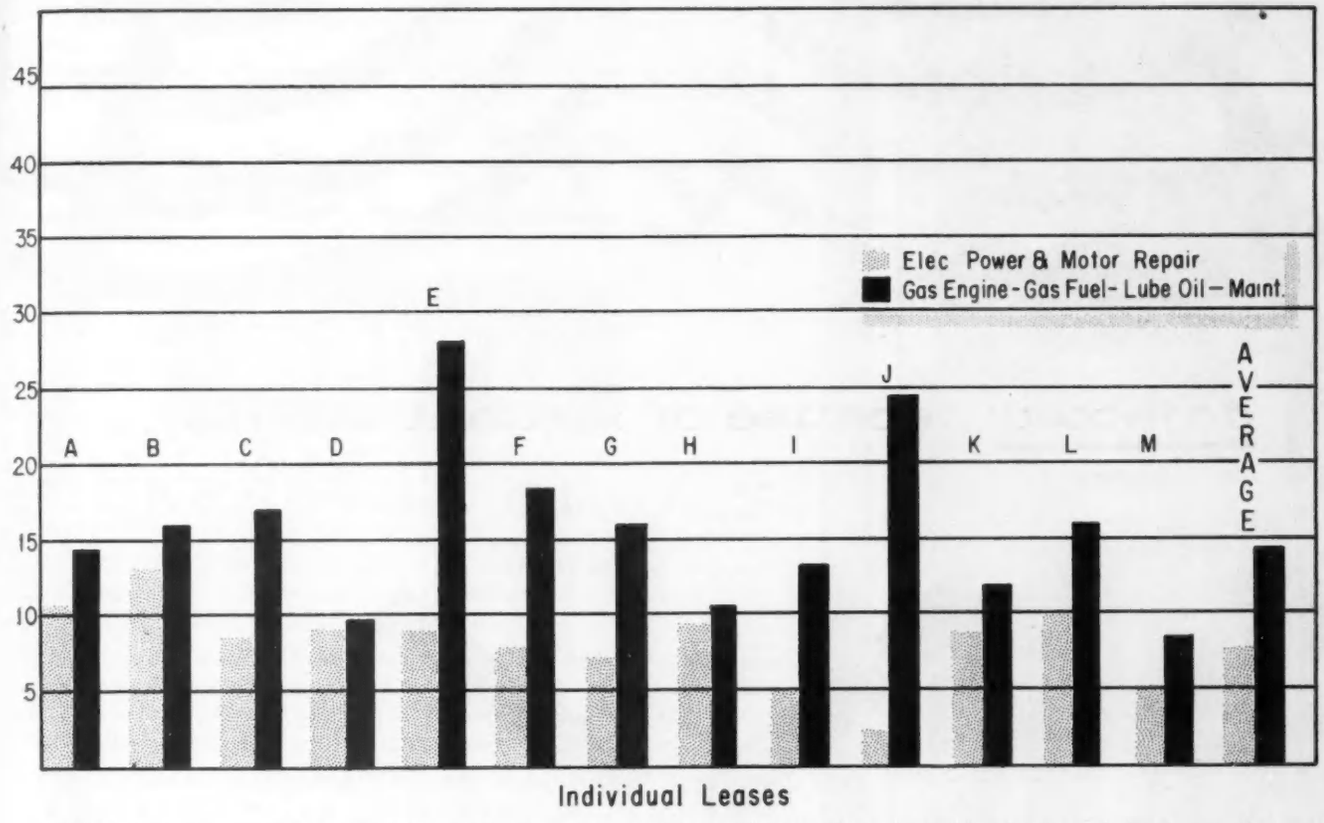


FIGURE 1—A comparison between electric and gas engine operation on 13 leases shows the double advantage of electric operation.

Take a look . . .

Electrification Pays Off

Cities Service Oil Company increased production and reduced expenses in the Pampa area with a good electrification program.

By WILLIAM L. BOOSA
Cities Service Oil Company
Pampa, Texas

EXPERIENCE OF Cities Service Oil Company in the Pampa (Texas) area indicates that electric operation of pumping wells will result in appreciable savings in labor and maintenance as well as increased production.

During 1955 and 1956, Cities Service has carried on a program of electrification of pumping wells in this area. To date, 240 wells, out of a total of 263 wells, have been converted to electric motor operation.

The results of this electrification program has been as follows:

1. A 21 percent increase in oil production or 2.1 barrels per day per well.

2. A 18.9 percent decrease in lease expense or $34 per month per well.

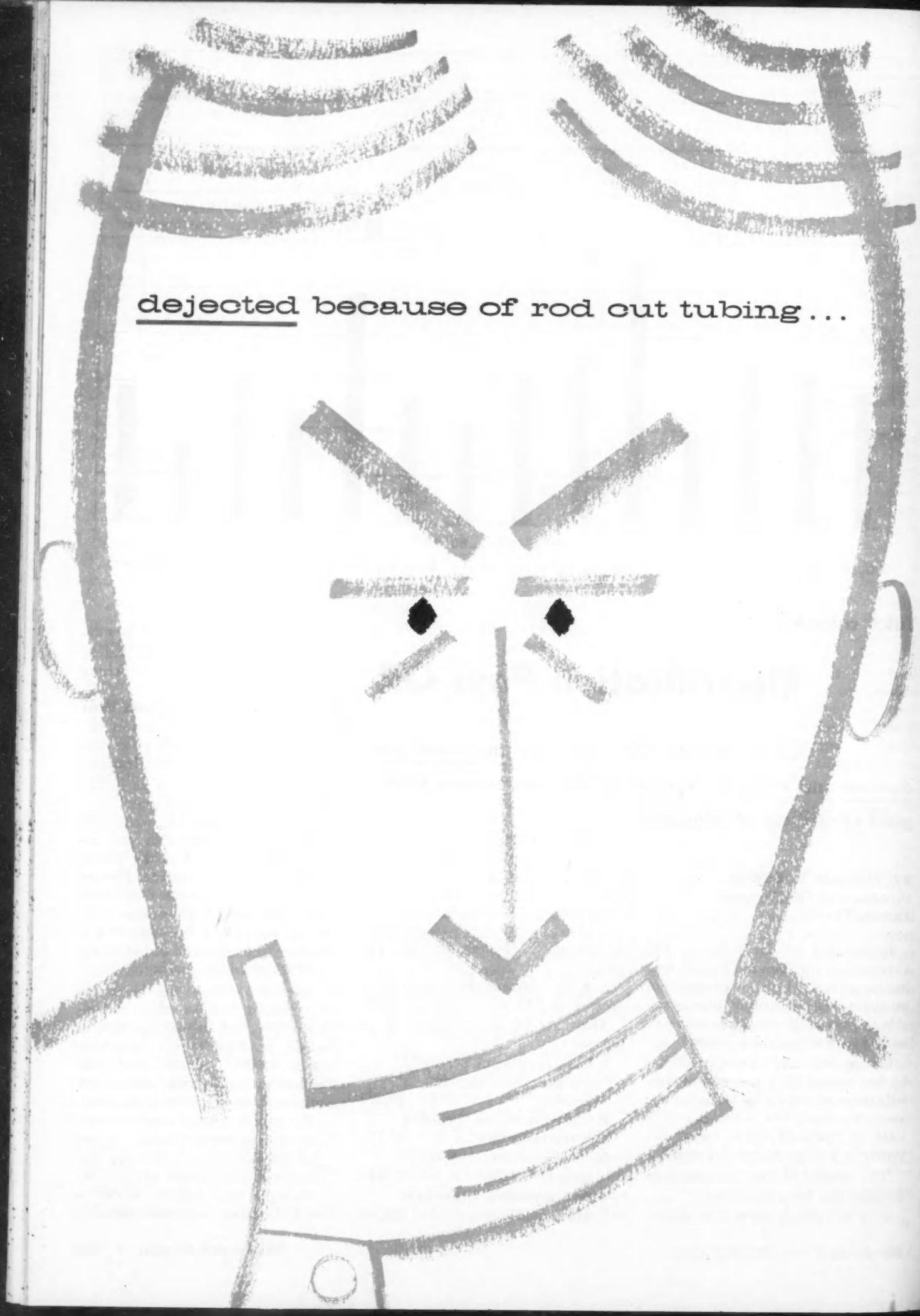
The cost of electrification is as follows:

1. Cash investment per well, pumping unit already installed $1,028
2. Cash investment including a pumping unit.....$2,661
3. Net investment with unit already installed .....$ 686
4. Net investment where unit was installed $2,541
5. Payout time where units were already installed 5.6 months
6. Payout time where units had to be installed .....14.5 months

Why Electrification Program Was Considered. Electrification of the Cities Service Pampa area leases was considered for the following reasons:

1. In a stripper field such as in the Pampa area, it is not possible to economically pump the wells with sufficient frequency with gas engines to produce all of the oil the well is capable of making. Electric motor operation with time clock operation would permit the wells to be pumped with sufficient frequency to produce all of the oil the well is capable of making.
2. Some of the leases are being gas repressured. It is desirable to schedule production so that the flow of casing head gas to the compressor plant is fairly uniform. Time clock operation with electric motors permits wells to be pumped automatically at any time of day or night.
3. Severe temperature fluctuations and the prevalence of blowing dust cause oil consumption and gas engine repair to be high in the Pampa area. Electric motors are relatively

dejected because of rod cut tubing . . .



FOR TUBING PROTECTION

specify

oilmaster

SUCKER ROD GUIDES

OILMASTER Sucker Rod Guides are used as a means of centering the sucker rod string in the tubing—eliminating wear on the rods and couplings—minimizing and distributing the wear on the tubing.

They are designed with the fluid passage in the form of a helix, with the bearing areas overlapping to give the effect of a continuous smooth bearing surface against the tubing. The annular clearance plus the area of the passages provides a liberal area for fluid to flow past the guide.

The wear surfaces of the **OILMASTER** Sucker Rod Guides are faced with a thick coating of Colmonoy—a torch-applied hard facing material that possesses an exceptionally low coefficient of friction against the relatively soft steel of the tubing. The fact that it is possible to obtain both a low coefficient of friction and a high wear value is explained by the micro-structure of the Colmonoy material. It is composed of hard crystals of Boron and Chromium in a nickel matrix. Under microscopic examination, these crystals assume an exceptionally smooth overlapping pattern—presenting a surface which will slide readily over a mating surface with no tendency to seize and a minimum of frictional drag.

FLUID PACKED PUMP CO.

Main Office and Plant, Los Nietos, California

Distributed by the National Supply Co., Pittsburgh, Pa.
Export: The National Supply Co., Export Division,
600 Fifth Avenue, New York
Co-Distributors: Union Supply Company,
Beacon Supply Co., Industrial Supply Co.

New 3/4" Rod Box in 2½" tubing. Note comparatively small contact area.

Worn 3/4" Rod Box in worn joint of 2½" tubing. Note how wearing away of a small amount of metal has made joint dangerously thin.

OILMASTER Rod Guide in new joint. Note large contact area which reduces and distributes wear.

Illustration shows application of OILMASTER Sucker Rod Guide with 3/4" sucker rods in 2½" tubing as it replaces a coupling in the sucker rod string.

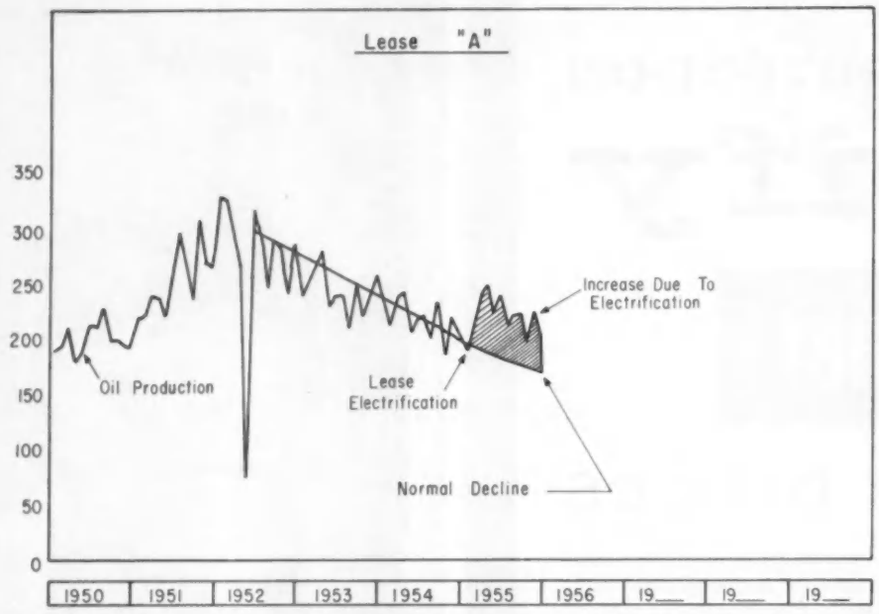


FIGURE 2—Daily average gross oil production. Note increase after electrification above normal decline curve.

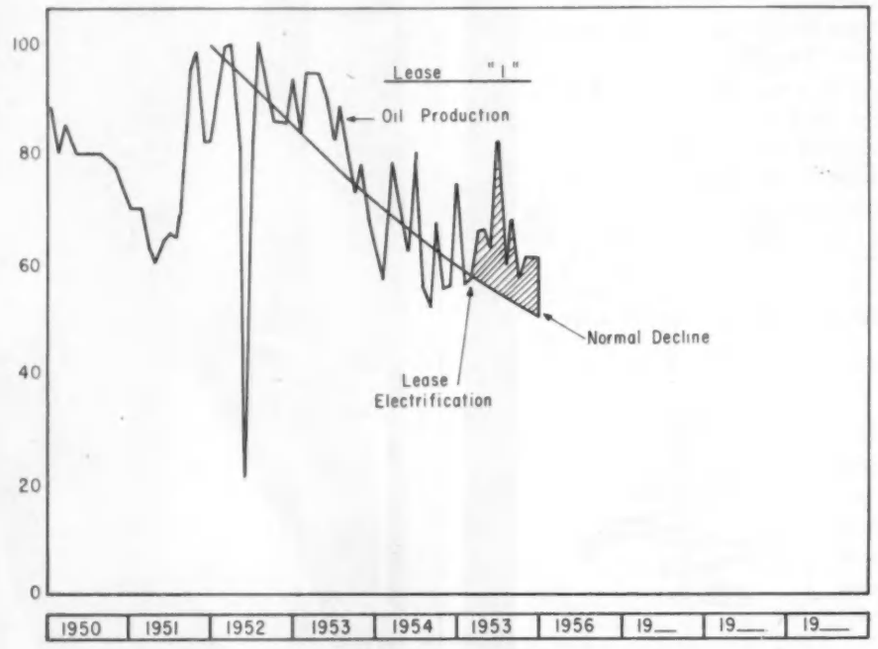


FIGURE 3—Daily average oil production on another electrified lease. A similar increase is experienced.

unaffected by temperature changes and blowing dust.

4. Starting, stopping, and servicing gas engines requires a large part of a pumpers time. Cold weather operation is especially arduous and time consuming. Electric motors normally need little or no attention even under adverse weather conditions.

From the above considerations, the decision was made to electrify two leases in the Pampa area. No remedial work or other changes were made on these leases before and after electrification so that the results of electrification could be evaluated. The results of these original installations were so satisfactory that the electrification program was carried out on most of the Cities Service leases in the Pampa area.

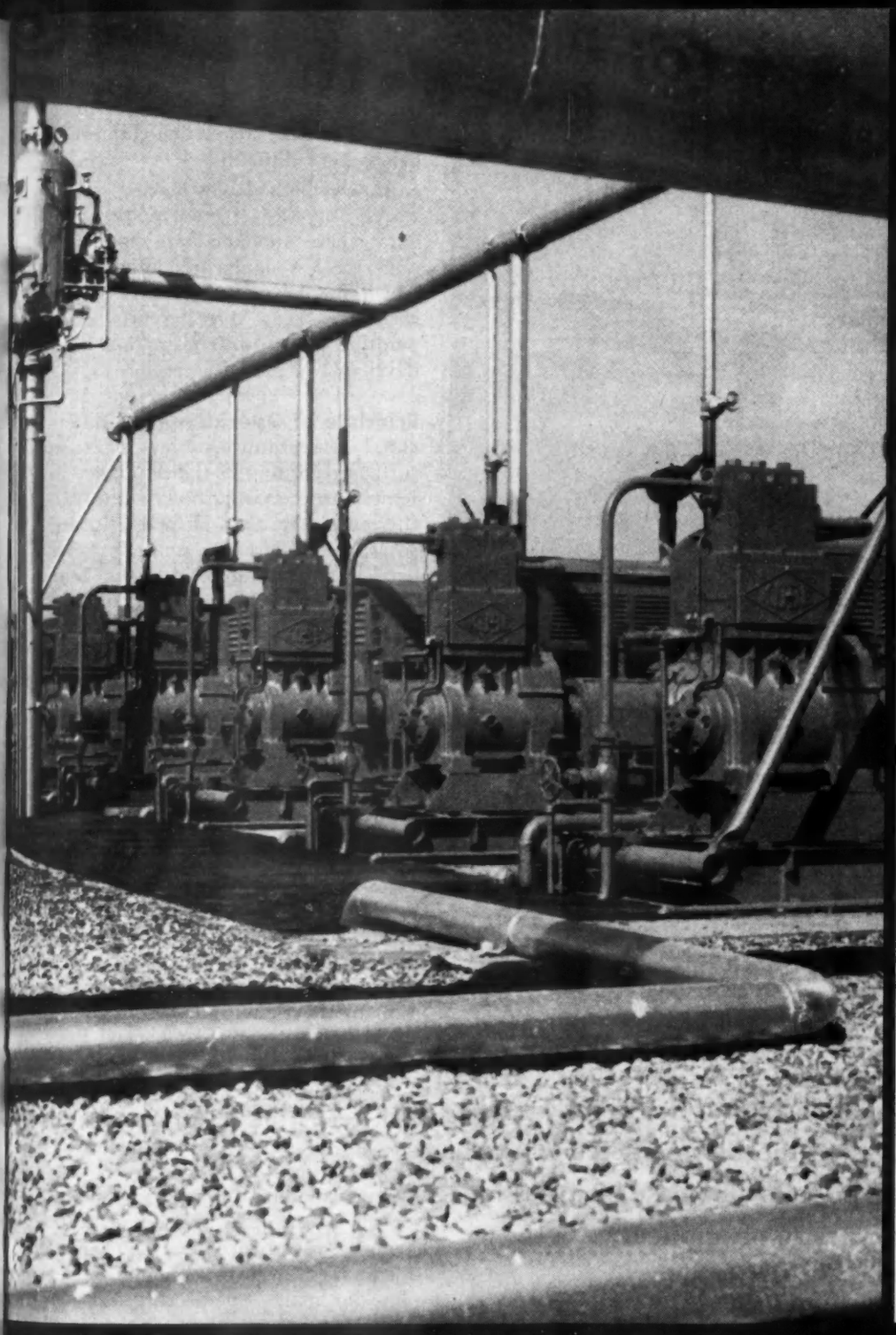
Results of Electrification. As a result of the electrification program, the following advantages were realized:

1. Gas engine repair cost was high. This expense has been eliminated. Electric motor maintenance has been extremely low.
2. The expense for lubricating oil was entirely eliminated.
3. The cost for gas fuel was eliminated.

Figure 1 shows the comparison between electric operation and gas engine operation on the individual leases in the Pampa area. The bar graph shows the comparative maintenance cost of electric motor operation and gas engines on 13 different leases. The costs included for the electric motor are electric power cost and motor maintenance. The costs included for the gas engine are gas fuel, engine repair, and lube oil. Costs are in dollars per month per well. On an average, maintenance and power costs were reduced from $14 per well to $8 per well per month due to conversion to electric motor operation.

4. Optimum use is now being made of the field labor force. Pumper productivity has almost doubled under the electrification plan. Cold weather starting, changing and adding lube oil and other maintenance chores necessary to gas engine operation is entirely eliminated.
5. Oil production has increased due to electric motor operation. Time clock controls on electric motors allow the wells to be pumped with sufficient frequency to obtain the maximum oil production. The smooth and steady power delivery to the pumping unit and well has resulted in less down time due to unit breakdowns, rod parting, and less down time for engine repairs.

Even after electric power was installed, a further improvement in pumping costs was made by use of electric instruments for adjusting counterbalance, and for determining exactly when the well was pumped off. One of the most useful instruments in this work was the recording graphic watt-hour meter. With this instrument, it was possible to determine the optimum number of times to pump a well to get the maximum production without pumping off. Electric energy costs per barrel of oil before using the watt meter was $0.0312 and after balancing the well and adjusting the frequency of operation, the cost was $0.0211 per barrel. Figures 2 and 3 are production curves on two leases which were electrified. No remedial work was done on either of these two leases before or after electrification. Both leases show a significant increase in oil production due to electric operation. —**The End**



This is the better, easier way to pump oil wells...

IT IS, OF COURSE, THE KOBE HYDRAULIC OIL WELL PUMPING SYSTEM

Because: IT COSTS LESS TO INSTALL

IT COSTS LESS TO MAINTAIN

IT COSTS LESS TO OPERATE

IT OFFERS A SIMPLE SOLUTION TO PRODUCTION PROBLEMS

IT SIMPLIFIES LEASE PLANNING

IT IS 100% SALVABLE

D

Free Pump®

KOBE

HUNTINGTON PARK, CALIFORNIA

The downhole element of this differential temperature surveying tool is shown here. The author, right, and an associate point to the thermally sensitive elements mounted five feet apart in the 1¼-inch diameter carrier.

Making Temperatures Talk

Production men have put to work a super-sensitive instrument that is to the thermometer what the microscope is to the eye. The following case histories indicate its effectiveness in a variety of applications.

By JOHN DISCH
Westronics, Incorporated
Fort Worth, Texas

TEMPERATURE ANOMALIES are frequently caused by irregular conditions in the bore hole, and these anomalies are highly significant in the study of downhole conditions. But many anomalies are small, such as those associated with small water and gas leaks in casing, and are therefore difficult to detect. The location of small anomalies, less than one degree deviation from the normal gradient, by conventional temperature logging methods has been uncertain and unconvincing. Increasing the sensitivity of the gradient temperature survey in an effort to show the small anomalies is of little use, for the recorder begins to move off scale due to geothermal gradient and must frequently be rebalanced for every few feet of depth recorded. This rebalancing produces a log broken at every reset point and make correlation with other curves very difficult.

A new method was needed in the search for additional temperature data where anomalies are small but none the less significant, information which lies beyond the reach of the gradient survey. A differential temperature survey instrument has been developed to meet this need.

Principle of Operation. The differential temperature survey makes a surface recording of the difference in temperature existing between two thermally sensitive elements spaced several feet apart on a small diameter carrier and lowered into the bore hole. These sensitive elements operate in a balanced electrical circuit, sending a minimum reference signal to the surface as long as normal gradient temperatures are encountered. Under these conditions the reference signal is recorded as a line down the center of the chart. When the leading element enters a temperature disturbance, the circuit is unbalanced and produces large recorded deflections for very minute anomalies. Recorder deflection to the left of the reference line indicates that the tool has encountered temperatures cooler than normal, while recorder deflection to the right indicates that temperatures warmer than normal have been encountered.

The system is highly sensitive. A difference of .02° F. between the elements will produce one inch of recorder deflection at full sensitivity.

It is standard practice to log only on the downward traverse in order to reduce disturbance in the logging medium. Also it is common procedure to make several runs through critical areas so that the "fixed" anomalies will correlate and can be distinguished from the minor "transient" anomalies which do not repeat on successive runs.

The carrier is 1¼-inch O.D. tubing and is lowered on a 3/16-inch diameter single conductor cable. Wells having up to 2000 pounds per square inch pressure can be logged by using the lubricator which, along with the mast and other accessory equipment, are part of the complete self-contained logging unit.

This differential temperature sur-

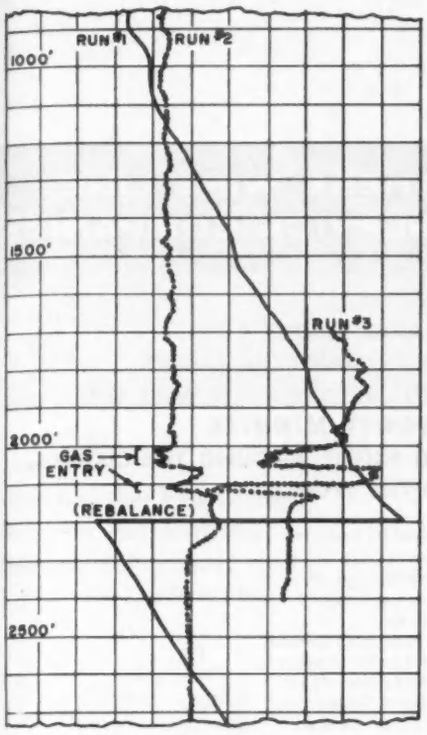


FIGURE 1

Run 1—1°/inch gradient temperature—well static.
Run 2—Differential temperature survey—15% —sens.—Flowing annulus between 7-inch and 9⅝-inch casing.
Run 3—Differential temperature survey—35% sens.—same as Run 2.

vey can be effectively applied to any downhole condition involving fluid or gas movements, where slight temperature anomalies exist or can be created.

The following field examples illustrate a few of the many applications of this instrument.

• Locating Gas Entry into Casing —Well in Abell Field, Pecos County, Texas.

Figure 1. This pumping well developed 900 psi pressure in the annulus between the 7-inch oil string and the 9⅝-inch salt string. The 7-inch casing had no pressure and the annulus between the salt and the surface had no pressure. The problem was to locate the gas entry into the annulus between the oil and salt string.

This annulus was opened and vented to the atmosphere. A gradient temperature, Curve 1, was run and a small anomaly was recorded between 2000 feet to 2100 feet. A differential temperature survey, Curve 2, was run and pinpointed the gas entry at 2010 feet and 2050 feet and 2100 to 2120 feet. A second survey, Curve 3, was run at higher sensitivity

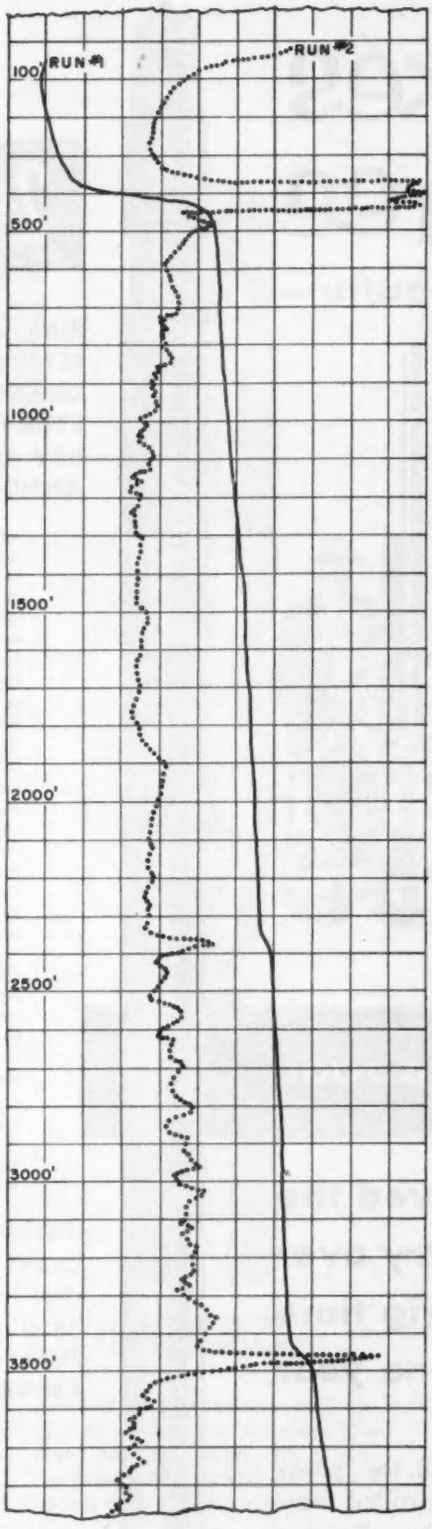


FIGURE 2

Run 1—Gradient temperature—10°/in.—well static.
Run 2—Differential temperature survey—10° sens.—well static.

and the same points were recorded with good correlation.

Cement was pumped down the annulus and squeezed with the result that the gas entry was closed off and pressure build-up in the annulus was eliminated.

• Locating Gas Channeling—Well located in Sibley Field, Webster Parish, La.

Figure 2. A differential temperature survey was run on several wells in this field to locate the source of gas that was channelling to fresh water sands, water wells, abandoned holes and creek beds.

It was discovered that this well was the conductor for the gas, but not the originator. From the survey, it was found that gas was coming from another well, through the two sands located at 3470 feet and 2370 feet. Gas was coming into the bore hole of this surveyed well at these two points, moving up the hole and charging the fresh water sands from 350 to 550 feet.

As a remedial measure, the casing was perforated and squeezed opposite the two sands. Shortly thereafter, the gas had dissipated its energy in the fresh water sands and from all surface indications, the channelling was completely stopped.

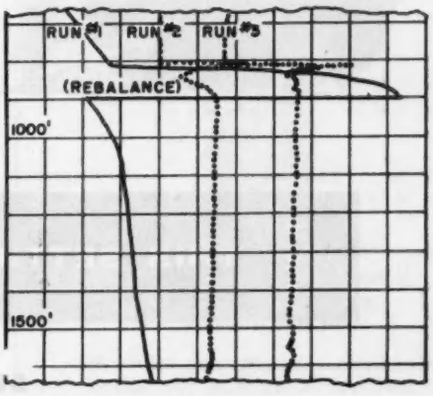


FIGURE 3

Run 1—1°/inch gradient temperature—well static.
Run 2—Differential temperature survey—10% sens.—well static.
Run 3—Differential temperature survey—25% sens.—well static.

• Locating Casing Leak, Water Entry—Well in North Ward Estes Field, Ward County, Texas.

Figure 3. In this old well, production had turned to 100 percent water. The problem was to determine whether water was coming from the producing formation or from a leak in the casing.

A 1°/inch gradient temperature was run, Curve 1, to determine the true geothermal gradient. A gradient of 0.8° F. per 100 feet was observed to approximately 800 feet, at which point an abrupt increase in

It takes all three

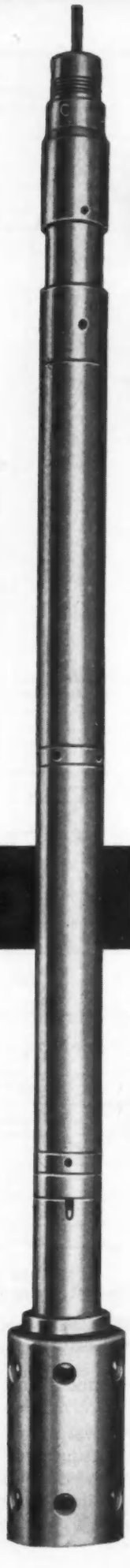
to get results—

1 THIS SETTING TOOL

saved the Oil Industry over 4 years of rig time ...*in one year*

The Baker Wire Line Setting Tool, the "power package" that supplies the controlled force necessary to set Baker Bridge Plugs, Retainer Production Packers and Cement Retainers on wire line, brought *dependable, time-saving* wire line bridge plug and packer service to the oil industry.

This tool brought together (a) the established performance of Baker Bridge Plugs and Packers with (b) the highly efficient wire line service organizations, thus providing operators with a dependable source that saved the oil industry an estimated four years of rig time *in one year.*

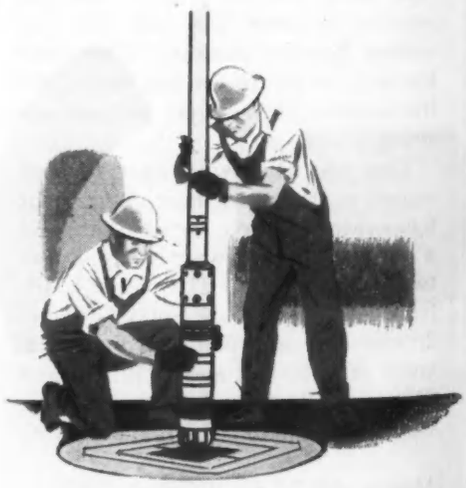


2 THESE WIRE LINE SERVICE COMPANIES

RUN A BAKER BRIDGE PLUG, RETAINER PRODUCTION PACKER, OR CEMENT RETAINER ON WIRE LINE, EVERY FORTY MINUTES DAY AND NIGHT, AROUND THE CLOCK... *AROUND THE WORLD.*

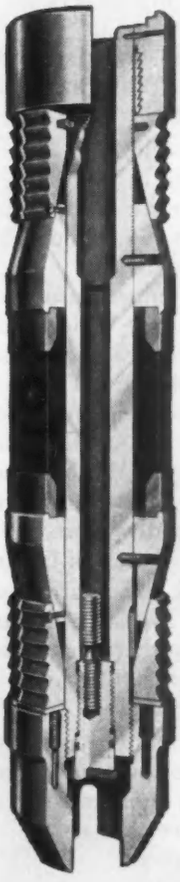
Advanced Oil Tools, Inc.
B-J Services, Inc.
Bird Well Surveys, Inc.
The Dia-Log Company
Dowell, Inc.
Flash Perforating Company
Ford Alexander Corporation
Frontier Perforators, Inc.
Go Oil Well Services, Inc.
Great Lakes Petroleum Services, Inc.
Huskey Guns, Inc.
Independent Perforators, Inc.
Lane-Wells Company
Lane Wells Canadian Company
McCullough Tool Company
Perforating Guns-Atlas Corporation
Perforating Guns of Canada, Ltd.
Petra-Tech Service, C. A.
Ram-Guns, Inc.
Schlumberger Well Surveying Company
"Schlumberger" Surenco, S. A.
Schlumberger of Latin America, S. A.
Schlumberger Overseas, S. A.
Servicios Technicos Atlas, C. A.
Societe de Prospection Electrique
Trinidad Oilfield Services Limited
United Oilwell Service, S.A.
Welex Jet Services, Inc.
Welex of Canada, Ltd.
The Western Company
Worth Well Survey
and other recent lessees

The combined trained personnel of these companies comprises a service organization with over 1,000 men in the field. Nearly 400 service locations ensure maximum availability of Baker Wire Line Bridge Plugs, Packers and Cement Retainers.



3 THESE PRODUCTS

Provide the end result: Superior Performance, Dependability with Maximum Drillability.

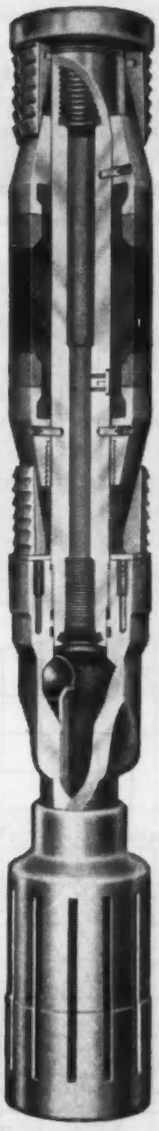


BAKER WIRE LINE BRIDGE PLUG
Product No. 400-N

Provides dependable, leak-proof, pack-off even under conditions of extreme pressure and temperature.

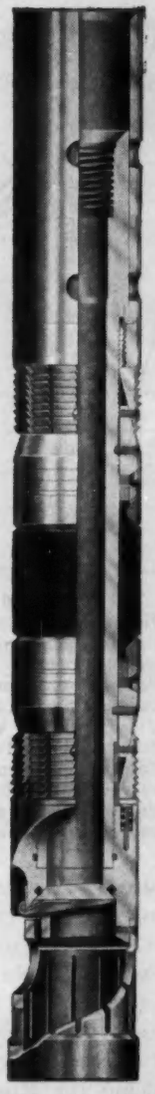
Drills up easily because in addition to being short, it has been especially designed to break up under the action of the bit.

Is immediately available everywhere, in either cast iron or magnesium.



BAKER WIRE LINE CEMENT RETAINER
Product No. 400

Provides the same reliable performance established over the years, plus many new advantages. Try it with the Stinger or Latching Subs for a variety of new applications.



BAKER WIRE LINE RETAINER PRODUCTION PACKER
Product No. 415-D

Provides unsurpassed performance under *any well condition* and a versatility that permits superior application for any production or packer requirement, including:

· SINGLE ZONE · DUAL ZONE · DUAL ZONE CROSS-OVER · PERMANENT WELL COMPLETIONS · PARALLEL STRING COMPLETIONS · OFF-SHORE INSTALLATIONS · GAS INJECTION · WATER INJECTION · TESTING

Over 85% of all Retainer Production Packers are now set on wire line.

BAKER
OIL TOOLS, INC.
HOUSTON · LOS ANGELES · NEW YORK

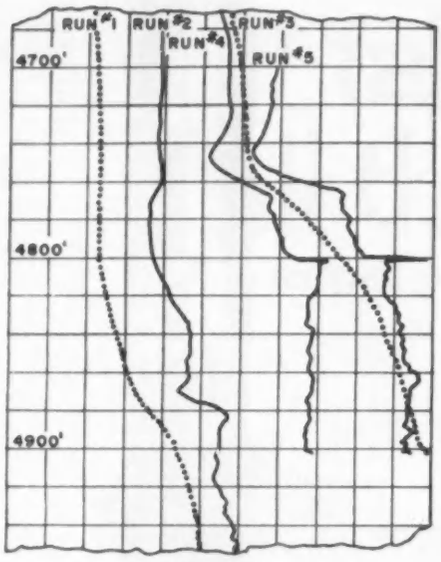


FIGURE 4

Run 1—1°/inch gradient temperature—before frac treatment—well static—well had been gassing for three hours.
Run 2—Differential temperature survey—35% sens.—same conditions as Run 1.
Run 3—1°/inch gradient temperature—after frac treatment—well shut-in.
Run 4—Differential temperature survey—25% sens.—same as Run 3.
Run 5—Differential temperature survey—50% sens.—same as Runs 3 and 4.

temperature was recorded. Below this point, however, the geothermal gradient was observed to be 0.13° per 100 feet, which is subnormal.

The sharp break in the differential temperature survey, Curves 2 and 3, indicated a leak in the casing at 808 feet, allowing the Rustler formation water to enter the well.

From the gradient temperature survey, it was determined that the water was entering the well, maintaining a fluid level at that point, and flooding into the formation at the same rate of flow.

A liner with a packer was set just below the leak in the 7-inch casing. After pumping for several weeks, the well returned to normal production.

• Locating Entry of Frac Fluid—Well in Monahans Clearfork, Texas.

Figure 4. A differential temperature survey was run on this old well to find the entry into the formation of a fracturing fluid.

It was desirable to know where the frac fluid entered the formation. After a treatment of 20,000 gallons and 20,000 pounds sand, two differential temperature surveys, Curves 4 and 5 were run to locate the formation which had received the frac fluid.

The main entry was established at 4732 feet to 4755 feet with some entry down to 4801 feet. No fracing occurred below that point.

• Water Entry in Injection Well—Well in Kermit Field, Texas.

Figure 5. The formations absorbing fluid in this water injection well were to be located. The well was shut in for 24 hours and remained static while a gradient survey, Curve 1, was run. This curve showed some activity beginning at 2778 feet and continuing on to total depth.

A differential temperature, Curve 2, was run also with the well static and showed prominent temperature anomalies at several points which correlated closely with Curve 3 which was run while water was being pumped into the well. Curves 4 and 5 were made with the well again static after a brief injection period of 45 minutes and served to show that the upper two zones, 2778 to 2814 and 2832 to 2836, were taking most of the water. Other entry zones at 2858 to 2869 and 2918 to 2926

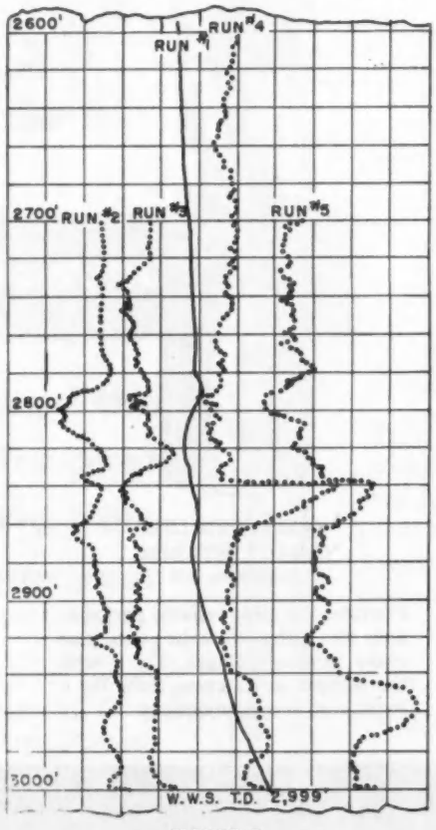


FIGURE 5

Run 1—1°/inch gradient—well static after 24 hour shut-in.
Run 2—Differential temperature survey—25% sens.—well static.
Run 3—Differential temperature survey—25% sens.—flowing into well at rate of ⅔ lbs. per minute.
Run 4—Differential temperature survey—50% sens.—well static after 45 mins. flowing into well.
Run 5—Differential temperature survey—50% sens.—well static.

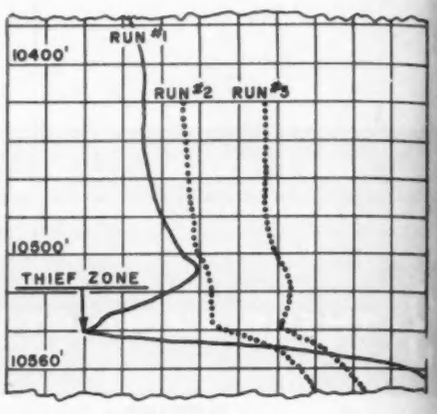


FIGURE 6

Run 1—Differential temperature survey—25% sens.—well static four hours after flowing into well with water.
Run 2—Differential temperature survey—5% sens.—flowing water into well.
Run 3—Differential temperature survey—5% sens.—30 min. after flowing water into well.

were taking very little and there appeared to be no injection below 2940.

• Locating Loss of Circulation Zone—New Well in Andrews County, Texas.

Figure 6. A thief zone developed in this well while it was being filled with water following perforating operations and it was impossible to completely kill the well.

Water was pumped into the well for one hour during which time the thief zone absorbed a large quantity of relatively cool water. The well was then shut in and held in static four hours, allowing the small volume of water remaining in the bore hole to assume normal gradient temperatures much more rapidly than the thief zone with its large mass of cool water.

A differential temperature survey was then made as shown in Curve 1 and produced a sharp break at the cool thief zone extending from 10,510 feet to 10,541 feet.

Curve 2 was run at greatly reduced sensitivity while pumping into the well and shows fluid moving downhole to 10,541 feet but no fluid moving below that point.

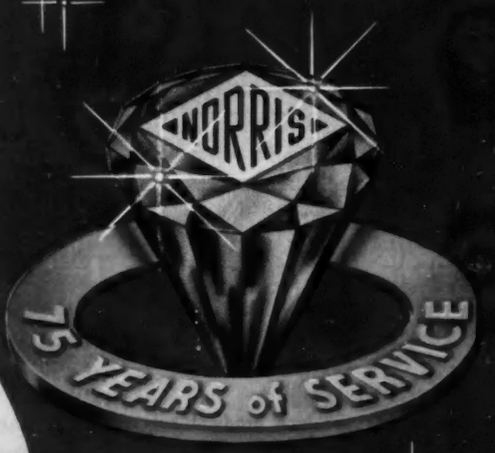
Curve 3 was run 30 minutes after the well was again shut in and held static and shows the tendency of the static water column above the thief zone to return rapidly to normal gradient temperatures while the thief zone remains cooler.

• Locating Small Tubing Leak—Well in Crossroads Field, Lea County, New Mexico.

Figure 7. A small tubing leak in

Get the Best

NORRIS QUALITY FITTINGS



W.C. NORRIS MANUFACTURER, INC.

TULSA, OKLAHOMA

BRANCHES:

GREAT BEND, KANSAS; CORPUS CHRISTI, HOUSTON, KILGORE, ODESSA, WICHITA FALLS, TEXAS; OKLAHOMA CITY, OKLAHOMA; SALEM, ILLINOIS; CASPER, WYOMING;

Since NORRIS 1882

WEST COAST DIST. REPUBLIC SUPPLY CO. OF CALIF., LOS ANGELES

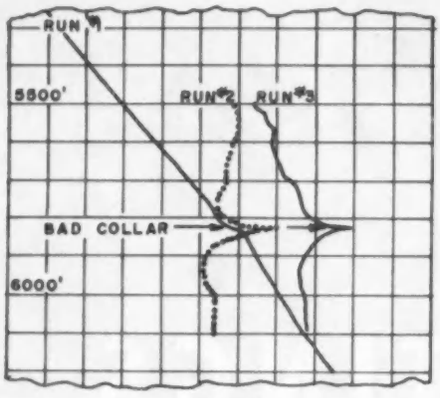


FIGURE 7
Run 1—1° per/inch gradient.
Run 2—Differential temperature survey—25% sens.
Run 3—Differential temperature survey—25% sens.

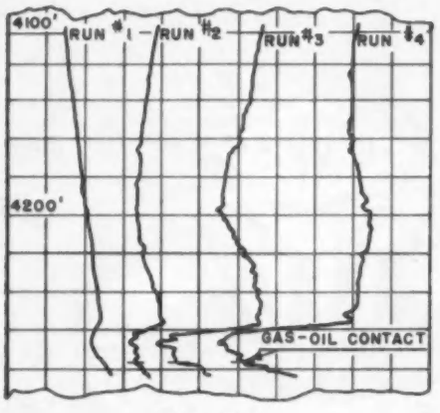


FIGURE 8
Run 1—One degree per inch gradient survey CSG, flowing.
Run 2—Differential temperature survey, 20% of maximum sensitivity CSG, flowing.
Run 3—Differential temperature survey, 50% of maximum sensitivity CSG, flowing.
Run 4—Differential temperature survey, 50% of maximum sensitivity, well shut-in.

this flowing well could not be located by repeated visual inspection of the tubing. The leak was very small as indicated by the fact that when a pressure of 1000 psi was applied to the water-filled annulus, this pressure would drop only 20 psi in 30 minutes as water leaked into the tubing.

An initial run in the tubing with the most sensitive gradient temperature survey Curve 1 (1° per inch) indicated a small anomaly and possible water entry between 5810 feet and 5870 feet.

Having localized the probable leak zone by means of the gradient temperature survey, the differential temperature survey was then run in that area at 25 percent sensitivity, Curves 2 and 3, to pinpoint the leak at 5284 feet.

After the surveys were completed, the tubing was measured as it was pulled out of the hole. A collar at 5827 feet was found to have damaged threads. When this collar was replaced, the tubing leak was completely eliminated.

• Locating As Oil Contact—Well in Goldsmith Field, Ector County, Texas.

Figure 8. In this old producing well the gas-oil ratio had become excessive and it was essential to locate the gas-oil contact, set a packer, and reduce the GOR.

Prior to the temperature surveys the well was allowed to flow extensively in order to develop a cool zone at the point of gas entry.

A preliminary gradient temperature survey of 1° per inch (Curve 1) showed the top of the gas producing zone at 4258 feet but failed to show any break defining the gas-oil contact.

Three differential temperature survey runs (Curves 2, 3, 4) indicated with prominent breaks to the left the top of the gas zone to be at 4258 feet, and then located with a sharp break to the right the gas oil contact at 4277 feet. Curves 3 and 4 were run at higher sensitivity than Curve 2, repeating the same significant anomalies but with greater amplitudes.

A packer was set at 4280 feet and as a result the gas-oil ratio was lowered to the required limits and the well was put back on its top allowable.

• Locating Zones of Productivity —Well in the Jamison Strawn Field near Silver, Texas.

Figure 9. After perforating this well and fracing it with a large volume of frac medium, it was desirable to determine which portions of the perforations were giving up fluid. The two differential temperature survey logs shown in Figure 9 indicated cool areas at seven zones in the perforations extending from 6130 to 6215, indicating fluid moving in from the formation into the fluid column. The perforations extending from 6220 to 6230 were not producing any fluid and show a warmer indication on the log.

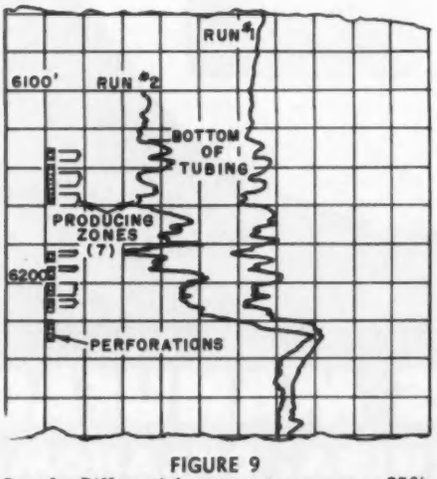


FIGURE 9
Run 1—Differential temperature survey—25% sens.—well static.
Run 2—Differential temperature survey—50% sens.—well static.

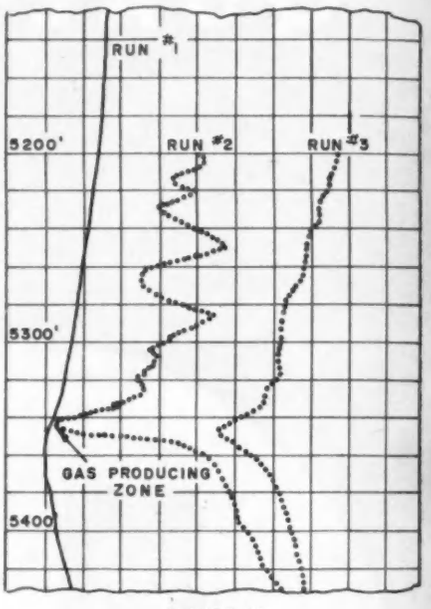


FIGURE 10
Run 1—10°/inch gradient temperature—well flowing.
Run 2—Differential temperature survey—10% sens.—well flowing.
Run 3—Differential temperature survey—2% sens.—well flowing.

• Locating Gas Producing Zones —Wildcat in Sutton County, Texas.

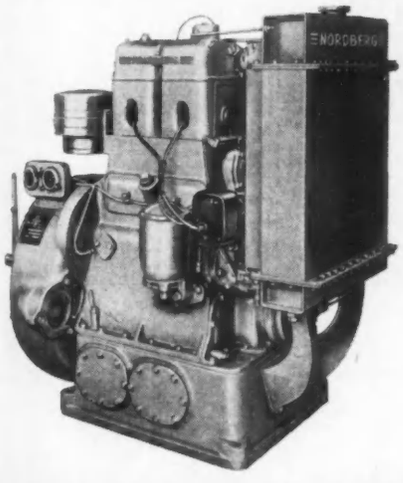
Figure 10. A few hours after drilling to TD and before electric logging, the gradient temperature survey Curve 1 was run to locate the general area of the gas producing zone. This was followed by the differential temperature survey, Curves 2 and 3, at 10 percent and 2 percent sensitivities respectively, to define sharply the gas producing zone between 5330 feet and 5349 feet. Curve 2 above 5300 feet indicates the numerous transient temperature anomalies present in the bore hole as the gas moves upward from the producing zone. The only fixed anomalies are those recorded at the points of gas entry. By correlating Curve 3 with Curve 2, it is apparent that the major fixed anomaly is between 5330 feet and 5349 feet.

—The End

NOW...

available from

FRED E. Cooper, Inc.



NORDBERG POWER CHIEF ENGINES

NATURAL GAS, GASOLINE and DIESEL ENGINES up to 45 H. P.

In the low cost medium speed POWER CHIEF engines you get all the design, construction and fine quality that has made Nordberg engines famous throughout the world for over 50 years.

POWER CHIEF engines are so simple in design that they can be maintained, in the field, with only a few ordinary hand tools.

Such FEATURES as these make POWER CHIEF the best buy: Removable wet cylinder liners • Valves in head • Replaceable valve guides • Special alloy inserted exhaust seats • Positive full pressure lubrication • Internal ventilation bars entry of dirt • Crankcase and all other vital parts fully sealed • Oil heat exchangers maintain proper internal temperatures at all loads • Safety approved, enclosed heavy flywheel smooths out fluctuating loads • Fram oil filters • Vortox oil bath air cleaners • Wico & Bosch magnetos • Twin Disc clutches • Murphy safety shut-down devices • No extra added costs for these when you buy.

Nordberg POWER CHIEF engines are now sold and serviced by Fred E. Cooper, Inc., with almost 40 years of specialized experience in the application and operation of oil field engines.

One source for engines, parts and service — a Cooper sold POWER CHIEF must operate as specified.

COOPER portable well servicing, workover and drilling equipment

Self powered and self propelled machines.

Skid units with positive and full air friction clutch.

Trailer units for servicing, work-over and drilling.

Swabbing & bailing machines.

Special service winches for heavy duty work.

Write for catalog or ask the Cooper sales engineer to show you.

FRED E. Cooper, Inc.

P. O. Box 1890 TULSA, OKLA.

Branches: Houston, Odessa, Los Angeles, Olney

SALES AND SERVICE

Casper, Wyoming
Corpus Christi, Texas
Lafayette, Louisiana
Longview, Texas
Wichita, Kansas
Wichita Falls, Texas

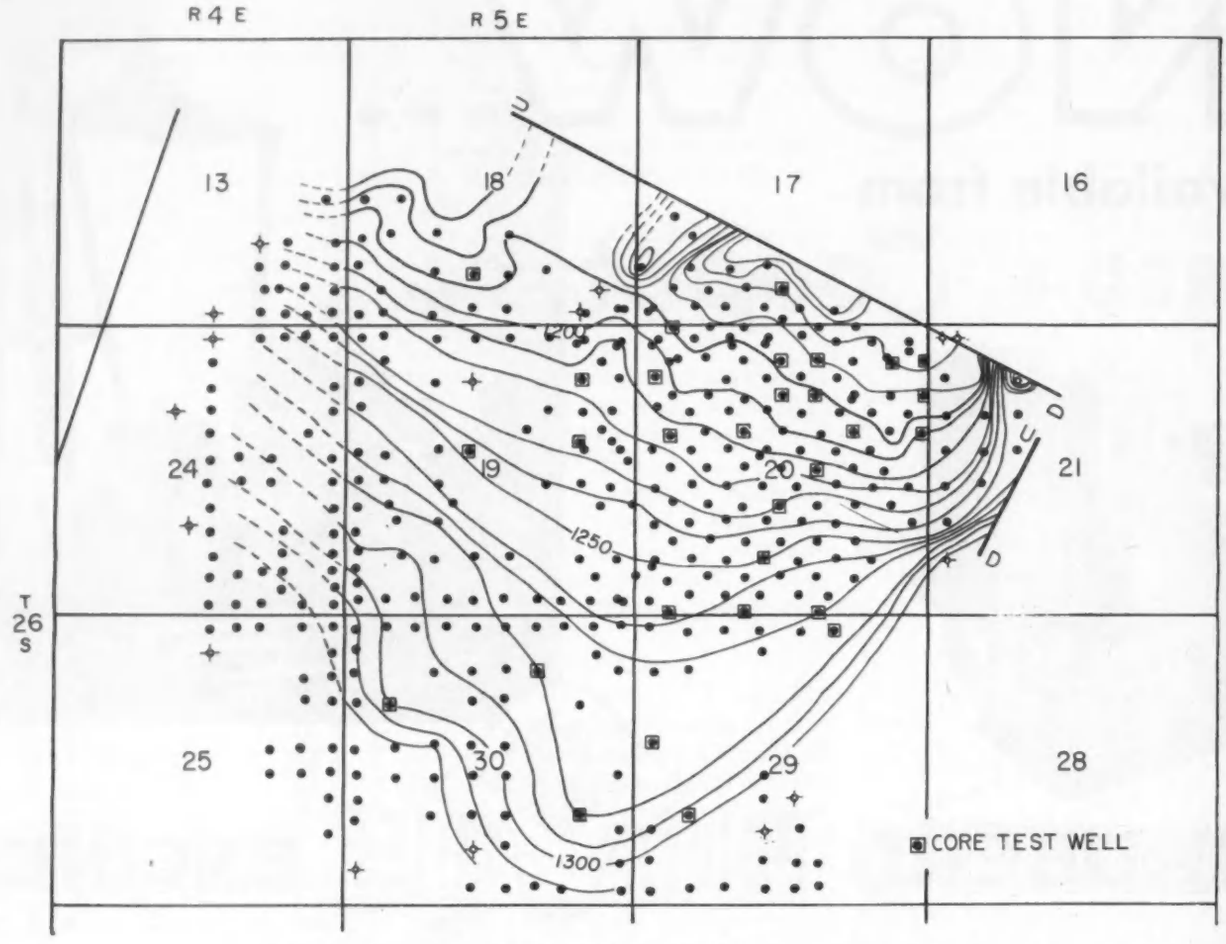


FIGURE 1—Contoured on top of the Simpson sand. Contour interval is 50 feet.

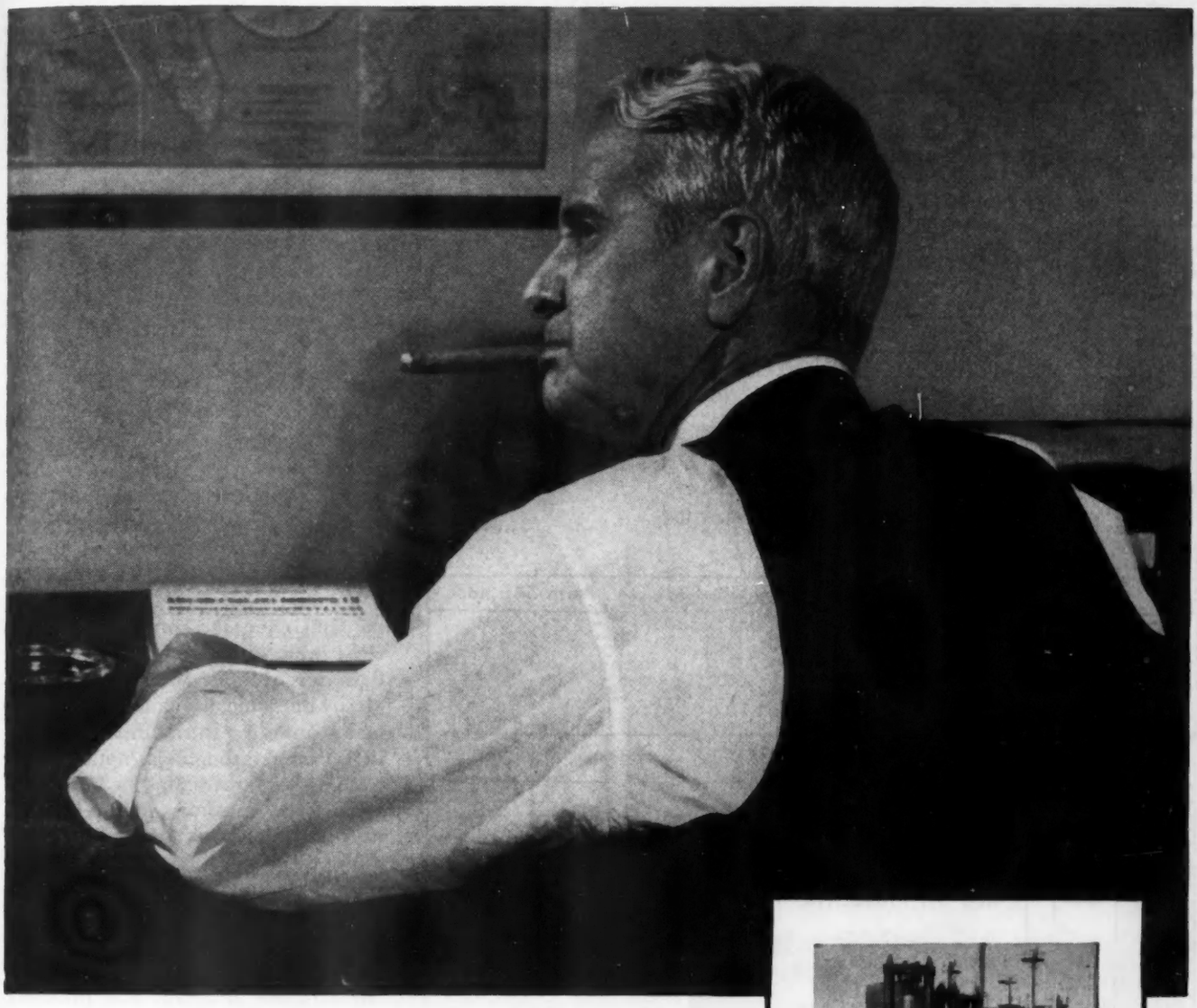
Two-zone production, early attempts at air-drive with resulting corrosion and emulsion problems and now water-flooding have made . . .

Unusual Operating Problems a Feature Of Koogler Water-Flood in Kansas

By S. S. MABRY, Petroleum Engineer
Cities Service Oil Company
Bartlesville

SECONDARY RECOVERY operations of Cities Service Oil Company's Koogler lease in Butler County, Kansas, are unusual in two respects: (1) production is from two widely-different types of reservoir rock at 2500 and 2600 feet which, for all practical purposes, must be considered as a single reservoir; (2) the area was previously subjected to an extensive air drive. These two combinations have caused some rather unique operating practices.

Geology. The El Dorado field lies along the trend of the Nemaha granite ridge and is formed by the El Dorado uplift. The structure is a truncated, faulted anticline with a major fault along the east side. A nose on the faulted anticline forms the Koogler Ordovician pool in the southern part of the field. The pool is bounded on the northeast by a fault branching from the major fault on the east side of the pool. The Koogler portion of the El Dorado field is south of the much publicized Arbuckle lime reservoir in which high permeabilities and a strong water drive created enormous initial potentials during early



"And I say it has to be an ALDRICH PUMP!"

Continuous, heavy duty pumping operations, often at high pressures, demand the complete reliability and freedom from maintenance found only in an Aldrich Pump. Top performance under these conditions has earned Aldrich its reputation for building pumps of highest quality and dependability.

The tougher the job . . . the more important it becomes to take advantage of our wide experience in providing the petroleum industry with pumps for water flood, pipeline, gasoline plant, hydrocarbon injection or petrochemical service.

In the less critical jobs, too . . . it makes sense to call Aldrich. The simplicity of the Aldrich Direct Flow design, with fluid-end sectionalization and automatically controlled delivery, offers substantial economies in both operation and maintenance.

A copy of our new condensed catalog, showing the line of Aldrich Pumps is yours for the asking. Write for Data Sheet 100.

The Aldrich Pump Company, 4 Pine Street, Allentown, Pa.

Shown above is one of a number of Aldrich 5" stroke, Triplex Pumps installed at a major west coast water injection project. These pumps are currently handling 35,000 bbl daily at injection pressures of 1,000 psi.

THE ALDRICH PUMP COMPANY

Field parts stock is available in Carmi, Ill., Charleston, W. Va., Houston, Tex., Los Angeles, Calif., Odessa, Tex., Tulsa, Okla.

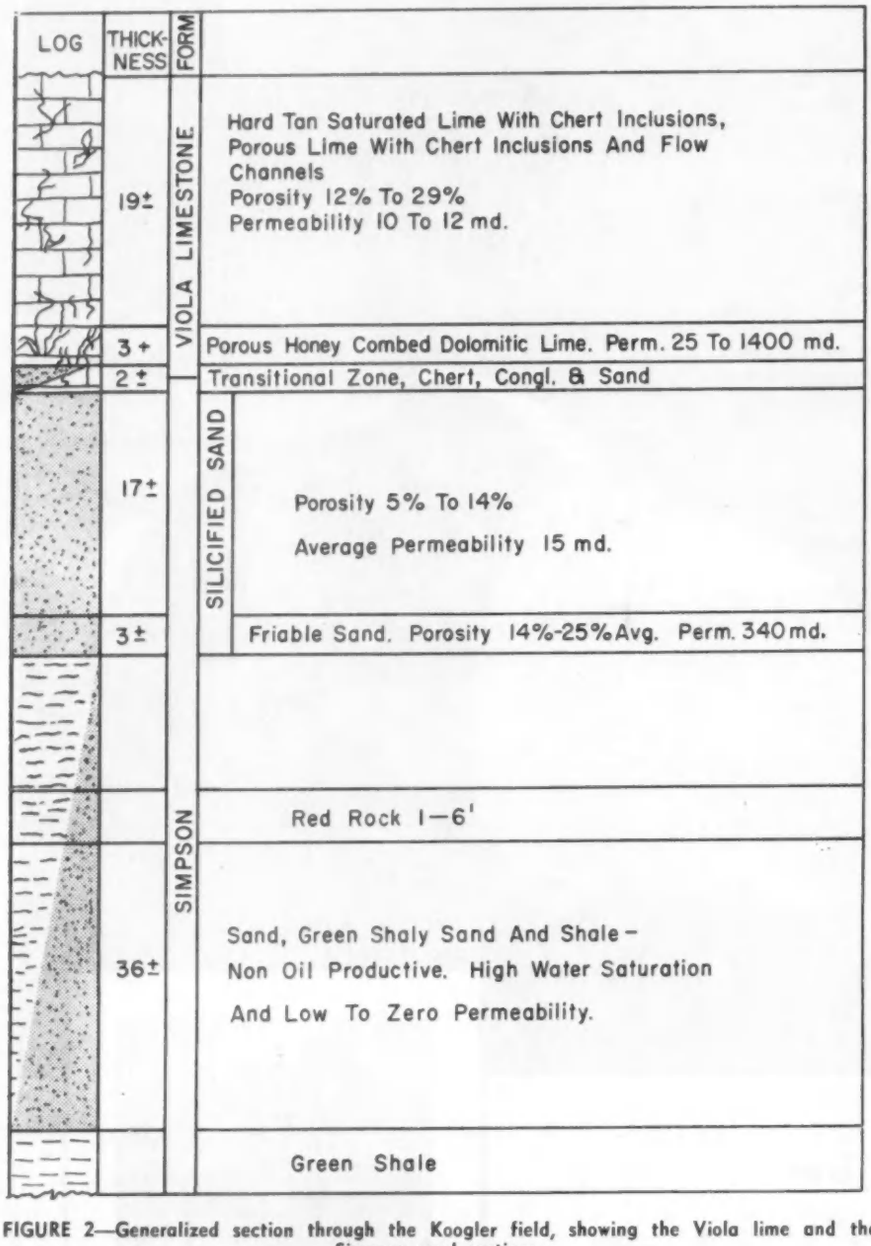


FIGURE 2—Generalized section through the Koogler field, showing the Viola lime and the Simpson sand sections.

development. A fault in the Ordovician isolated oil productive pay sections of Viola Lime and Simpson sand as shown on the plat in Figure 1, which is contoured on the Simpson sand. The Viola lime follows the same general structure as the Simpson. The subsequent discussion applies to the area south of the fault.

The Viola is a tan porous lime with chert inclusions and is quite variable having some vugular porosity with very high permeability. The Simpson sand lies below the Viola lime separated in part of the area by a hard tight transitional zone ranging up to four feet in thickness. This barrier is generally present in the north half of Section 20, but is not continuous over the entire area. A generalized section of the producing zones is shown in Figure 2.

Development. Drilling on the Cities Service Koogler lease started 38 years ago, in August, 1917. Development progressed slowly because of the relatively small potentials. Initial production from the average well was 50 to 100 barrels per day, whereas the prolific wells north of the Koogler lease produced up to 20,000 barrels per day on completion. Development was halted in 1920 because of the relatively low well productivity and was not resumed until 1926.

Early day completion practices were followed in setting casing at the top of the Viola lime without cementing and drilling in with cable tools. The Simpson sand was frequently not penetrated on structurally low wells. Prior to 1920 only the Simpson formation was shot, but later both pay zones were shot on completion. The advent of acid led to acidizing the Viola lime in most of the old wells during the mid-1930's. Current completion practice is to drill through and set pipe on top of the Simpson. The Viola is then perforated, acidized, and produced over a packer set near the top of the Simpson. The reason for this procedure will be discussed later.

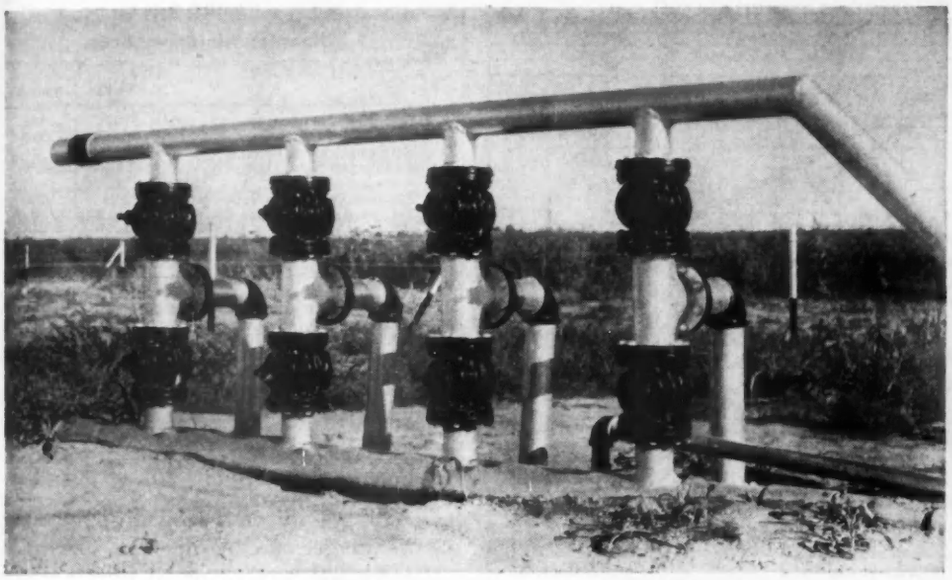
Air Injection. In 1928 an air drive program was started using several old wells for input. Little work was done on the input wells and both the Viola and Simpson were subjected to air pressure.

Figure 3 shows the wells used for the air injection program. Twelve wells were used, however, no more than seven input wells received air at any one time, although air volumes were controlled to minimize channeling. A breakthrough was noticeable in wells up to one-half mile from the input wells. In some wells an increase in production was noticed immediately upon injection of air into an offset well, and others were stimulated as far as three-quarters of a mile away.

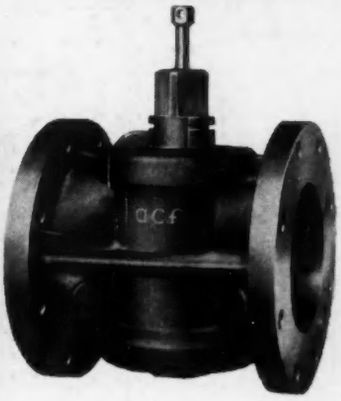
Lease production increased after the air-drive program was initiated; however, the increase cannot be entirely attributed to the air drive program because of a drilling program that started about that time. Between 1929 and 1930, 35 new wells were drilled and added to the primary recovery since fairly good wells would have been possible at these locations without air drive. Between 1930 and 1937 only one new well was drilled, but from 1947-1948 an additional 15 wells were completed.

A curve of the over-all air drive performance showing the daily rate of oil production is shown in Figure 4. Results of the air drive performance, as estimated from available data, are tabulated in Table 1. Of the total oil produced from the air drive area, 29 percent was attributed to air drive. It is believed that most of the oil produced by air drive operation came from the most porous section of the Viola lime with very little produced from the Simpson sand.

A noticeable physical change during the air drive period was that the



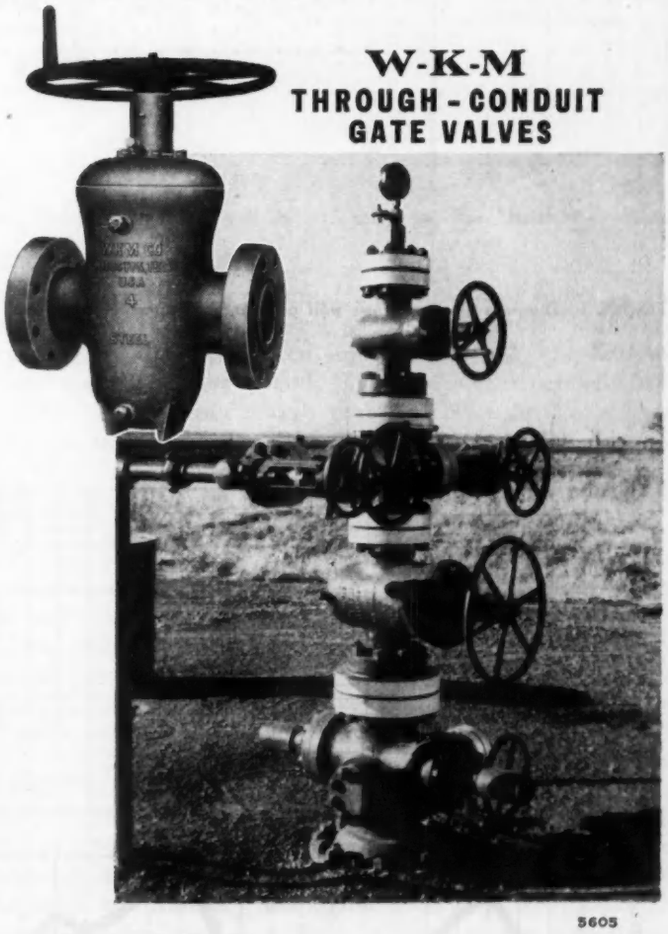
acf LUBRICATED PLUG VALVES



NOW-

Both High and Low Pressure Valves from W-K-M

W-K-M THROUGH-CONDUIT GATE VALVES



For your Christmas Trees, flow lines, and wherever else high pressures must be safely and positively controlled, there are the famous W-K-M- through-conduit gate valves, in working pressures from 1,000 to 15,000 pounds.

acf lubricated plug valves, of steel, semi-steel, and special metals, with round or rectangular ports, in working pressures from 200 to 500 pounds — are the perfect companion valves for gathering lines, manifolds, headers, and similar low pressure installations.

Because you need the finest in service wherever valves are required, you will be way ahead when you specify W-K-M or acf valves for their respective applications.

5605

W-K-M

DIVISION OF **acf INDUSTRIES** INCORPORATED

PLANT: MISSOURI CITY, TEXAS

MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

MANUFACTURERS OF

W-K-M THROUGH-CONDUIT GATE VALVES	acf LUBRICATED PLUG VALVES	KEY RETURN BENDS AND FITTINGS

For more data on advertised products, use Readers' Service Cards, last page.

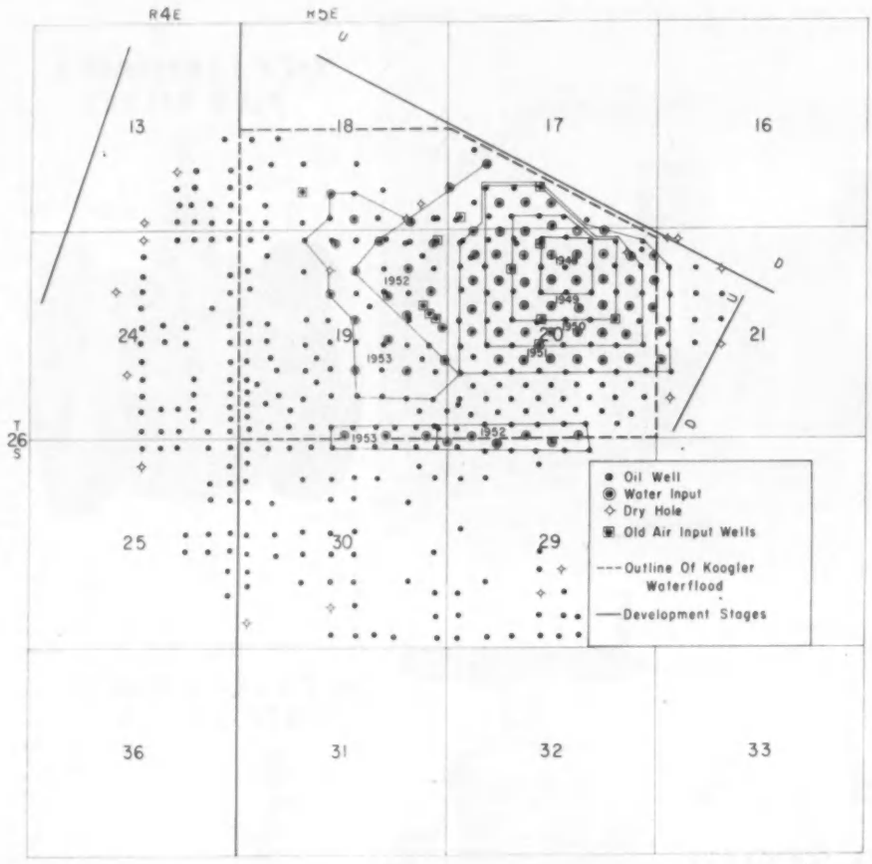


FIGURE 3—Diagram of area shows well pattern, development stages and area covered by flood.

TABLE 1

Koogler Air Drive Area

	Viola	Simpson
Producing area under air drive, acres	829	738
Gross thickness, average	23.1	56.3
Net pay thickness, average	18.5	20
Average porosity	21%	12%
Est. connate water	20%	30%
Est. initial reservoir volume factor	1.06	1.06
Est. initial stock tank oil-i nplace, bbl.	18,850,000	8,950,000
		Combined Zones
Est. initial aoil-in-place, stock tank bbl.		27,800,000
Est. recovery by primary methods		4,560,000
Est. recovery by air drive		1,980,000
Est. primary recovery, bbl. per acre		5,500
Est. air drive recovery, bbl. per acre		2,390
Est. total recovery (Primary and air drive %) of oil-in place		23.5%
Approximate daily air input		425 MCF
Wellhead injection pressures		40 to 300 psi

API gravity of the oil dropped from 34 degrees to 32 degrees. Corrosion increased because of air injection and caustic was used as a down-the-hole treatment. Air increased the emulsion problem requiring steam boilers to heat water in the gun-barrel plus the addition of a Cities Service developed treating chemical.

Pilot Water-flood. Koogler lease cumulative production to January 1, 1948, was 9,376,306 barrels, about 19 percent of the original oil-in-place. A total of 93 oil wells and 7 dry holes had been drilled on 10-acre locations but development was not complete. At

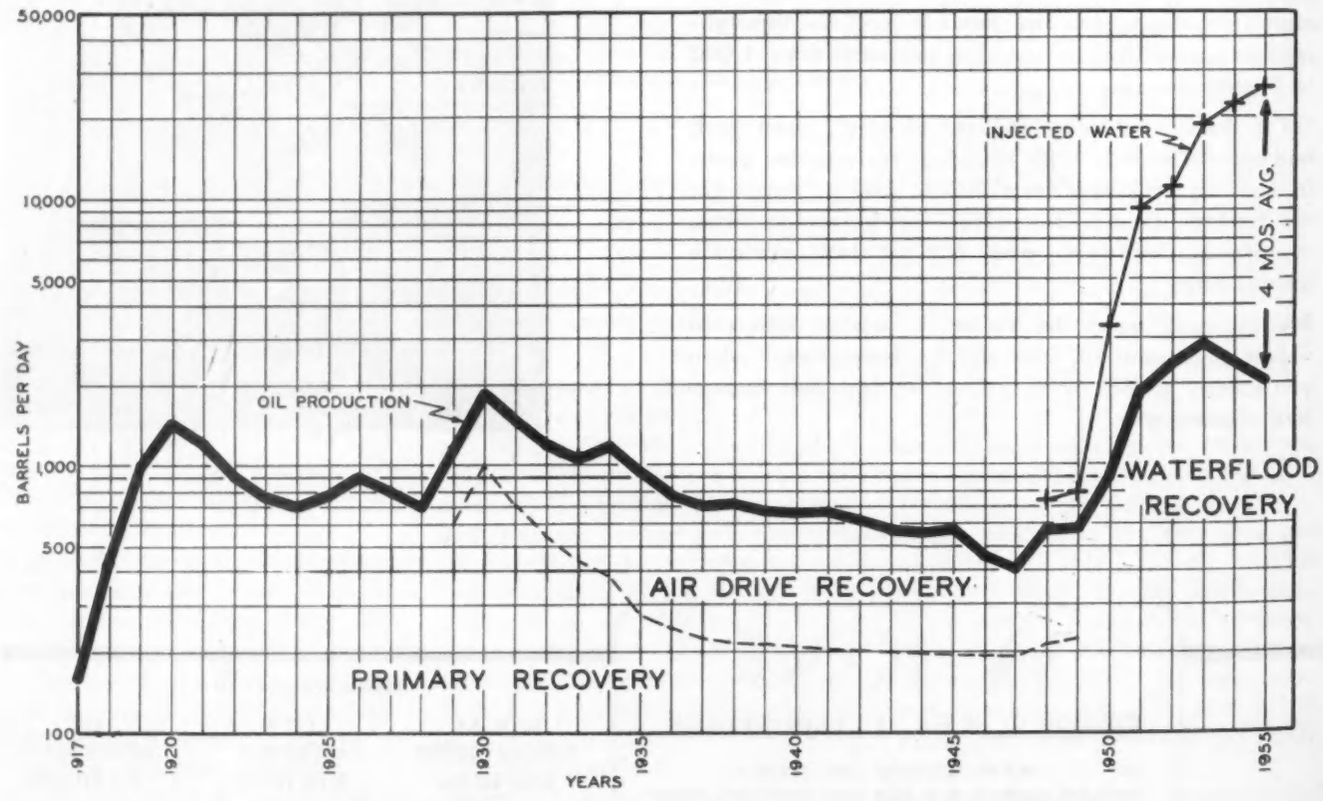


FIGURE 4—Koogler field performance curve shows primary, air drive and water-flood recoveries.

the start of the pilot flood 55 producers, 6 air injection wells, and 4 temporarily abandoned wells remained.

Since the Simpson formation was the lower strata, it was selected for the initial injection; the plan being to flood the Viola after the Simpson Zone was depleted and plugged off. Reasoning that a good primary producer would make a good secondary producer, Well 86 was chosen to be the center of a 5-spot pilot flood. The well was surrounded by four input wells with 4½-inch casing set through the Viola lime into the Simpson sand. The wells were cored with a diamond bit after it was found that a conventional bit had to be replaced after cutting only one foot of the Viola-Simpson contact. The wells were cleaned out and completed with cable tools, and injection of water was started in October, 1948, at a rate of about 250 barrels per day per well under gravity. Initial injection rates were 10 barrels per day per foot of sand but decreased because of a decline in the water supply which was obtained from a 900-foot water sand.

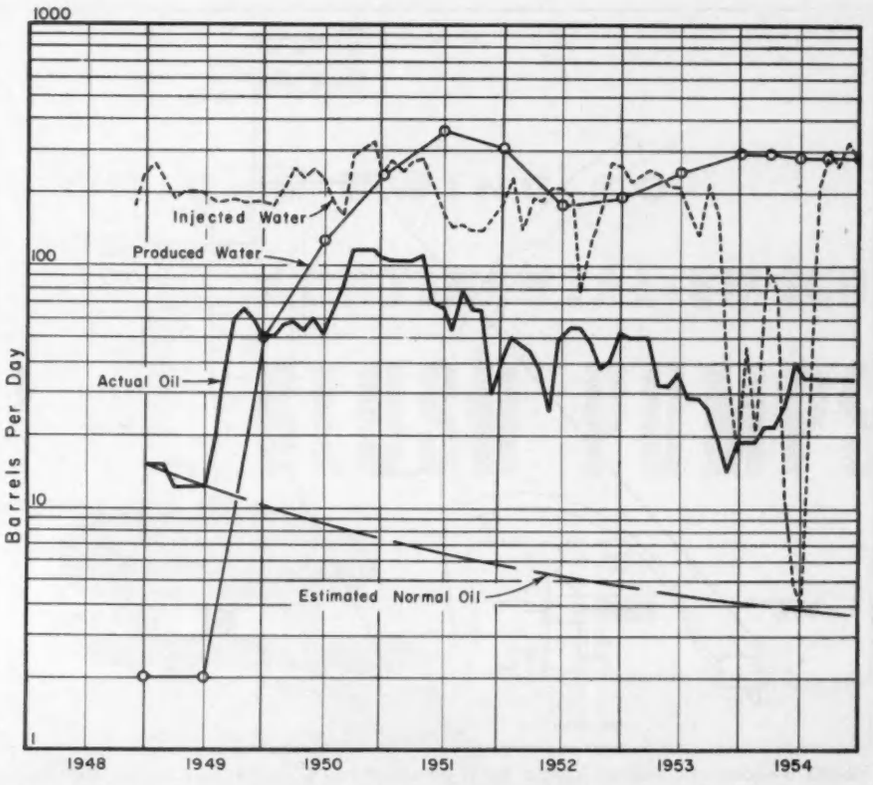


FIGURE 5—Performance curve of producing well 86 in 5 spot pilot flood leads to expansion.

Pilot Flood Increase. The first increase was noted in August 1949, about 10 months after commencing water injection, which corresponded favorably with the predicted time of fill-up calculated from data on the Simpson sand. The pilot flood consisted of 10 acres with one producer No. 86 enclosed by four injection wells and 25 acres surrounding them. Almost at the same time as the center well of the pilot responded, 5 other wells adjacent to the 4 input wells also responded. The group of 6 wells in the pilot flood increased from 81 barrels per day to 346 barrels of oil per day during a two-months period. Water production also increased.

The present production from the center well of the pilot is 25 barrels of oil, and 226 barrels of water per day and its cumulative oil production has been increased 90,951 barrels by the water-flood. A total of 1,722,050 barrels of water has been injected into the 4 pilot wells.

Performance of Well 86 is shown in Figure 5.

Expansion of Water-Flood. Only 45 days has elapsed between the time the first increase was noticed and the extension was begun by drilling input wells in 5-spot locations around the pilot flood. For the next two years the flood was extended by adding a ring of input wells around the previous year's development. When the east boundary of the lease was reached the offset operator joined in the input well program along the line, and the wells of this offset operator were also stimulated. In 1951 the south boundary of the original proposed flood limit was reached, and new wells being drilled south of this boundary indicated the Koogler water-flood would be much larger than originally estimated.

The remainder of Section 20 and nearly all of Section 17 were then included in a revised development program. It appeared also that flooding would be profitable in Sections 29 and 30. In Section 20, the 10-acre 5-spot program was continued; however, in Section 19 the Simpson was thinner and the acreage was poorly developed, so a 20-acre 5-spot pattern was adopted.

Reappraisal of Water-Flood Program. The water-flood performance appeared to be typical of a sandstone reservoir until July 1951 when production rates increased sharply in several wells located near the south boundary of Section 20, almost ½ mile from the nearest input well. Increases on some wells ranged from a normal 5 barrels to as much as 100 barrels per day. Although water had been injected into only the Simpson sand, increases were noticed from wells that had only the Viola open. This situation accelerated the drilling program of Cities Service and two rows of wells were rapidly completed as oil wells in input locations. The wells were completed with 4½-inch casing set into the Simpson from 2 to 4 feet. The Simpson sand was tested and found saturated with oil but did not yield any oil or water. After the Simpson was tested the casing was perforated opposite the Viola and the wells produced above a packer set at the top of the Simpson. The initial completion of these wells was about 40 barrels of oil and 100 barrels of water. Interference between wells was not appreciable.

These wells are currently producing about 304 barrels oil daily with about 87 percent water cut and have produced about 459,081 barrels to date. Wells completed in this manner are checked periodically below the packer to see if the Simpson is responding to water injection. The wells will later be converted to Simpson input wells after the Viola becomes nonproductive.

Cities Service joined with offset operator and drilled six input wells along the south line as is shown in Figure

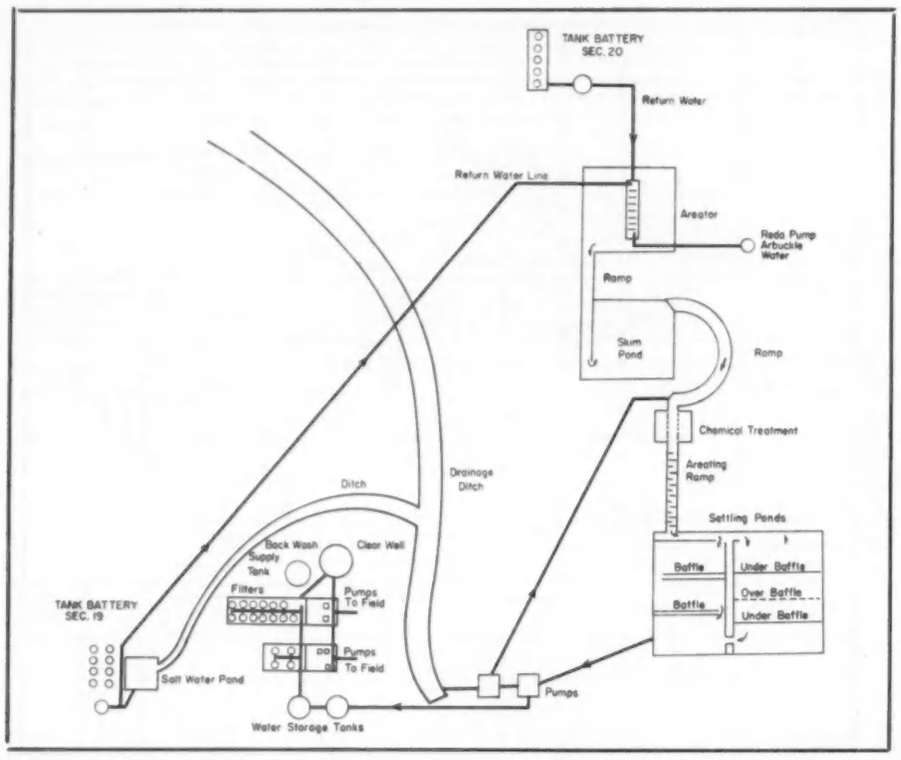


FIGURE 6—Schematic diagram Koogler water system. It may ultimately help recover 4000 barrels per acre.

4 late in 1952. A line agreement was made for water injection into the Simpson; however, migration of the oil into the Viola could be expected.

Water Treatment. For the pilot flood, water was obtained from a 900 foot water sand. For the first extension, water was taken from a creek which was partly fresh and partly salty with a chloride content of 10,000 parts per million and no H_2S. The water was chemically treated, settled, chlorinated, and filtered. No difficulty was encountered in treating the creek water.

As water supply from the creek dwindled due to drought and installation of salt water disposal facilities by the operators to the north, an Arbuckle supply well was drilled. The well was drilled 350 feet into the Arbuckle and cased 50 feet into the line with 8⅝-inch pipe.

A bottom hole pump currently produces 12,000 barrels per day with no draw down from a fluid level within 450 feet of the surface. About 100 ppm hydrogen sulfide is present in the Arbuckle water. Produced water is also used with H_2S content of 300 ppm and is very difficult to treat. At the present time, the water treating plant is an open system with both produced and supply water being aerated and mixed, then chemically treated, settled, and chlorinated before filtering and injection.

The present plant is capable of processing 30,000 barrels water per day. Additional filters will increase the capacity to 40,000 barrels per day. Currently, approximately 22,000 barrels are being treated daily.

A schematic diagram of the water plant is shown in Figure 6.

Results to Date. Performance to date indicates that the water-flood recovery will be 4000 barrels per acre ultimately. In the pilot flood area the Simpson has responded; however, in the remaining area only the Viola has responded. It is planned to plug off the Viola in the area where it has been stimulated and flood the Simpson when the Viola becomes non-productive. Currently the produced water-oil ratio is 4.13 to 1, the cumulative injected water-oil ratio is 69.5 to 1. Table 2 and Figure 4 give the statistics of the performance of water-flood.

TABLE 2
Cities Service-Koogler Waterflood (Viola and Simpson) Performance

Area Affected by Water-flood—Acres	1400
Accumulated Water Input, Bbls.	24,634,002
Accumulated Water Production, Bbls.	15,397,520
Accumulated Increased Oil Production, Bbls.	3,473,415
Increased Oil per Acre	2480
Current Daily Production, Bbl./Day	2219
Daily Input Rate, Bbls.	26,488
Average Input Pressure (Surface) psi	40
Number of Input Wells	72
Number of Wells Stimulated	151

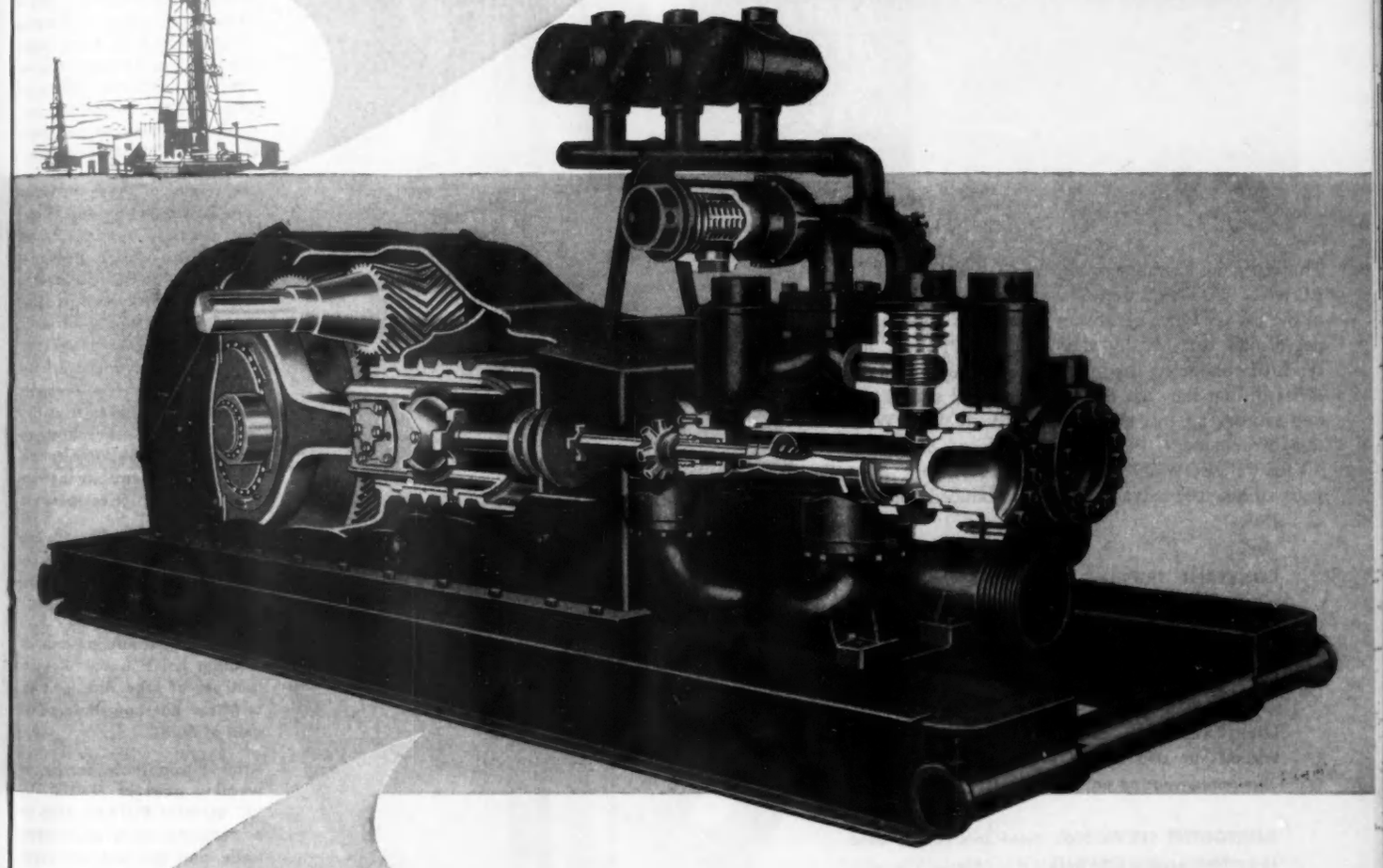
Operating Problems. Air injection caused corrosion problems. All lead lines have been replaced with cement-lined pipe. Individual lead lines were installed with headers and test meters installed at the batteries. This system replaced the original belt line system. Where excessive distances for individual lines occurred, a belt lead line was installed with groups of headers and test meters along the line. The 4-inch belt line and the 2-inch test lines were laid in the same ditch. Corrosion required the installation of strike plates on the bottom of the steel stock tanks under the thief hatch. Tank bottom corrosion was accelerated by the gage line-plumb bob chipping off scale from the tank bottom, exposing a new surface to corrode. The tanks were coated with asphalt base paint over the bottom and 18-inch up the side before being placed in service. This procedure has increased the life of the tanks considerably. Subsurface equipment is protected with inhibitors, either water or oil soluble, whichever is found to be the most efficient.

Effect of Air Drive on Water-Flood. Air-drive caused emulsion problems early in the life of the water-flood. Some wells produced as high as 30 to 40 percent basic sediment. The emulsion was very difficult to break, and hay section heater treaters were necessary, plus the addition of treating chemical to the lead lines. As the air was displaced from the formation, the emulsion problem diminished; however, heater-treaters are still in use requiring water temperature of 100° in summer and 130° in winter.

It was found that although the gravity of the crude was reduced 2° API by the air injection, the gravity increased to the original gravity after the air worked out of the formation during the water-flood. The increased oil produced during the air drive period and attributable to air-drive was believed to have been produced in the most part from the Viola lime as it has the greater permeability. Probably most of the oil recovered by air drive could have been recovered by water-flood without injecting air.

Cumulative Production. Including the primary production, air drive and water-flood, the Koogler lease has produced 13,320,816 barrels of oil, and it appears that the lease will be productive for several years. **The End**

There's a Reason FOR THE SWING TO CONTINENTAL-EMSCO SLUSH PUMPS



Here's the Picture Story

No matter what you want—more horsepower per pound, economy, ease of maintenance, automatic lubrication, "exposed" liner construction—you'll get it in the complete line of heavy duty, light weight Continental-Emsco Slush Pumps. Available in 6 sizes. Get the facts today from your nearest representative.

Distributors: Bovaird Supply Company, Tulsa, Okla.
Mid-Continent Supply Company, Fort Worth, Texas

Export Distributor: Mid-Continent Supply Co., Inc.
45 Rockefeller Plaza, New York 20, N.Y.

CONTINENTAL-EMSCO

Serving the Oil and Gas Industries ... Worldwide

CONTINENTAL-EMSCO COMPANY

A Division of The Youngstown Sheet and Tube Company

General Offices: DALLAS, TEXAS • Plants: LOS ANGELES • HOUSTON • GARLAND, TEXAS

Representatives in All Principal Oil Fields of the World

SP-702

BOWEN *presents a tremendous advancement in Rotary Jar construction*

SEALED LUBRICATION

— practically eliminates wear
— greatly reduces servicing
— assures constant tripping tonnage

NOTHING PROTECTS METAL SURFACES LIKE AN OIL BATH

The tripping mechanisms in SEALED TYPE "I" BOWEN ROTARY JARS are identical with those in the earlier types of Bowen Rotary Jars that have performed successfully the world over under all types of conditions for many years. These new Jars differ in that they are filled with oil and sealed top and bottom against the ingress of well fluid. With this arrangement, the moving parts of SEALED TYPE "I" BOWEN ROTARY JARS work in a bath of oil and advantages are produced thereby as follows:

CONSTANT TRIPPING TONNAGE: The tripping tonnage does not increase or decrease regardless of the presence of sand or oil in the well fluid. The tripping tonnage can be varied only at the will of the operator.

LUBRICATION: The oil bath extends the life of the Friction Slip and Friction Mandrel and practically eliminates wear on any other parts.

INFREQUENT SERVICING: These Jars can be used to perform several jobs before it is necessary to service them and the servicing procedure is simplified.

The floater is an important part in SEALED TYPE "I" BOWEN ROTARY JARS. It automatically moves up or down the Washpipe maintaining a pressure balance within the Jar and thereby avoids excessive pressures on the Seals.

SEALED TYPE "I" BOWEN ROTARY JARS are installed in fishing strings to enable the operator to strike heavy upward blows against an obstinate fish and knock it loose. They are also installed as safety devices in strings during testing, coring, reaming, drilling, sidetracking and washing-over operations. Their presence insures the operator of the ability to knock the string loose should it stick.

Outstanding Advantages

SEALED TYPE "I" BOWEN ROTARY JARS are *straight pull mechanical type rotary jars* which provide greater efficiency in jarring operations.

The ability of these Jars to strike heavy blows with a string completely free from torque eliminates any aggravating tendency to release the fishing tool below the jar. Torque free operation also reduces equipment wear and eliminates hazards.

The ability of these mechanical type Bowen Rotary Jars to operate successfully under all conditions has been proven in countless jobs throughout the world for many years. Since these jars are purely mechanical their tripping mechanisms do not depend upon a complicated series of packing elements. Hence their ability to deliver heavy blows is absolutely unimpaired by packing failures, abrasive elements in the circulating fluid or high temperatures.

These Jars will deliver the same heavy upward blows regardless of whether the string is elevated slowly or with great rapidity.

These Jars feature oversize circulating holes to permit unlimited use of wire line tools and to allow passage of large volume of fluid.

After considerable service, the wearing parts of SEALED TYPE "I" BOWEN ROTARY JARS can be replaced easily and economically and the tool will regain all the properties of a new one.

SEALED TYPE "I" BOWEN ROTARY JARS

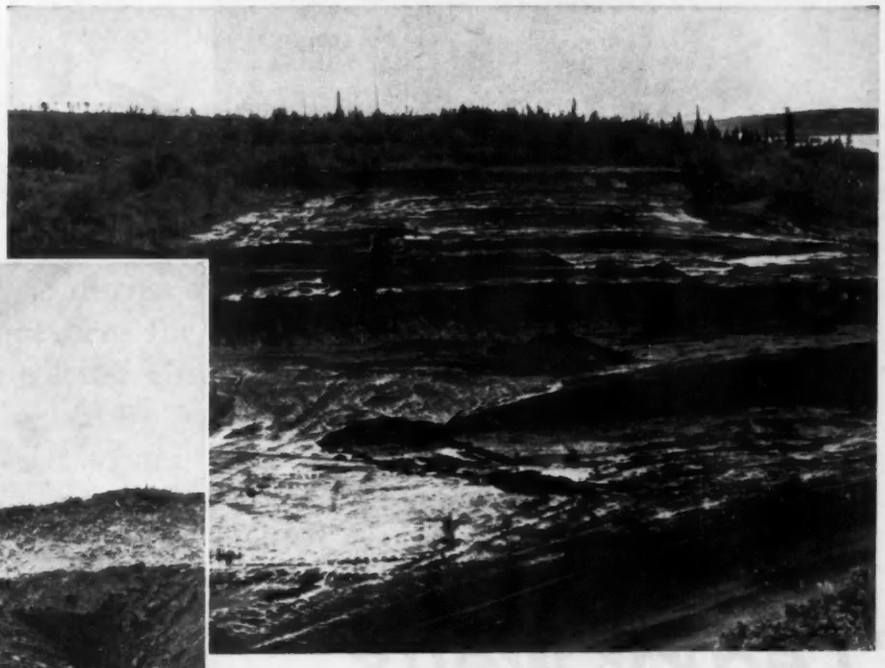
Write for descriptive literature

WORLD'S LEADING SUPPLIER OF FISHING TOOLS
Manufacturer of a complete line of fishing tools
The most complete fishing tool service facilities
World's largest exporter of fishing tools

SR BOWEN CO

MAIN OFFICE AND PLANT
11008 SOUTH NORWALK BOULEVARD
SANTA FE SPRINGS, CALIFORNIA
EXPORT OFFICE
30 ROCKEFELLER PLAZA
NEW YORK CITY, NEW YORK
EXPORT REPRESENTATIVE: VAL R. WITTEN

This dump truck is being loaded with oil-bearing sand from the Alberta government's oil sands project at Bitumont, north of Fort McMurray.



This is a section of the Athabasca oil sands, exposed to the surface near the pilot plant at Bitumont, Alta. The oil sands reserves are estimated to contain 100-300 billion barrels of crude.

In Canada's Athabasca Development

$50 Million Oil Sands Project Scheduled

Royalite Oil Company proposes to solve extraction problem with centrifuge process, and hopes to be moving 20,000 barrels of oil daily to market by 1960.

FIFTY MILLION dollars will be spent to develop Alberta's Athabasca oil sands, described as the world's largest visible reservoir of crude oil. In scheduling this expenditure, Royalite Oil Company, a Calgary company, proposes to extract oil from the oil sands with the Coulson process—a process developed by a Calgary building contractor, Gordon R. Coulson.

The Coulson process, a centrifuge operating on the cream separator principle to spin oil from the sands, may prove the solution to one of the Canadian oil industry's greatest problems. The Athabasca oil sands, extending over an area about 300 miles northeast of Edmonton, contain oil reserves variously estimated at 100 billion barrels to 300 billion barrels.

The problem until now has been to separate the oil and to move it to market at a profit.

Royalite's expenditure will pay for the construction of an extraction plant at Bitumont, in the oil sands area, and a pipe line to transport the oil from Athabasca to Edmonton.

Only preliminary work is scheduled for this year. Full-scale construction will be under way in 1959 and Royalite hopes to be moving 20,000 barrels of oil a day to market by 1960. While Royalite's announcement referred only to its "initial plans," it was understood that the project could be expanded to handle oil production in greater quantities.

Like Royalite, other companies hold oil sands rights covering 50,000 acres, the maximum permitted each under Alberta government regulations. Among the most active interests in the oil sands area is a ten-company team headed by Calvan Consolidated Oil and Gas. Calvan, controlled by Belgium's Petrofina organization, has been engaged in an extensive test hole program for the past five years.

The projected Royalite development program is in partnership with Can-Amera Oil Sands Development Company of Calgary, headed by Stanley Paulson, a Canadian oil man who invested in the Coulson process, and Coulson, developer of the process.

—**The End**

EXTRA!

EXTRA!

"Leaky wells lose money"

Is this news? Of course not. Every producer knows the importance of having leak-proof tubing joints in his pumping wells.

YOUNGSTOWN knows it, too. That's why we pay particular attention to thread tolerances and joint make-up in the manufacture of all Youngstown Oil Country Tubing.

Youngstown Seamless Tubing—available in H-40, J-55 and N-80 grades—is produced with either non-upset or external upset ends. Youngstown quality-controls all its integrated operations from ore mine to finished product—which assures you long, trouble-free field performance.

When you need Tubular Engineering Service or additional information, contact your nearest Youngstown Sales Office. You will find our Field Engineers as near as your telephone. Why not call today?

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices - Youngstown 1, Ohio

District Sales Offices in Principal Cities

Indian Minister Evaluates Oil

When Shri K. D. Malaviya, India's minister for Natural Resources, was in the U. S. recently to discuss oil equipment with representatives of this country's suppliers, the questions for this interview were submitted to him by WORLD OIL. Then, in a letter airmailed from India came the answers.

The letter was signed by A. M. N. Ghosh, technical member, Oil and Natural Gas Commission. He wrote: "Your letter of October 1, 1956, addressed to Shri K. D. Malaviya . . . enclosing several questions regarding the position of the oil industry in India, has been handed over to me for disposal. The information asked for is forwarded herewith."

By DON KLIEWER
World Oil Staff

Q *Rising crude production and an expanded exploration program combined in 1955 to highlight India's petroleum industry operations. What do you consider the highlights of the nation's oil industry for 1956?*

A The highlights of India's oil industry operation in 1956 were:

- Discovery of commercially workable oil reservoirs in the Brahmaputra valley at Nahorkatiya and Moran.
- Negotiations with private oil companies with respect to the formation of two or three rupee companies in the fields of oil exploration, refining and transport.
- The formation by the government of India of a high-powered commission called the Oil & Natural Gas Commission to deal with various aspects of oil industry in the country, including exploration by the government agency, so the future development in oil and natural gas exploration, exploitation and refining may be undertaken . . . in the public sector also.

Q *In December, 1955, an aeromagnetic survey was begun of 20,000 square miles in West Rajasthan, Northwest India, and was scheduled for completion in April, 1956. Can you tell us whether it has been completed and, if so, what program will result from it in the exploration field?*

A The report on the aeromagnetic survey in West Rajasthan is expected to be ready sometime in January, 1957. *(Editor's note: This interview, held earlier, was cleared through the Indian government by letter dated November 30, 1956, hence the report on the survey may already have reached the government.)* From the preliminary interpretation of data, it is suspected that the thickness of the marine sediments in the West Rajasthan region is greater than was previously thought.

When the report is made available, it is expected to throw some light on the probable thickness of the sediments in this region and to help in selecting suitable and favorable sites for undertaking detailed ground geological and geophysical investigations.

A comprehensive program of geophysical investigations in Jaisalmer area has been drawn up and seismic, gravity and geological parties will be starting work in a few days (as of November, 1956) under the supervision and guidance of foreign and Indian experts in these fields.

Q *It is recalled that the Indian government established an Oil & Gas Division under the Ministry of Natural Resources and Scientific Research in 1955 so that it could become more active in oil matters. How has the establishment of this division brought about more government activity in the oil industry?*

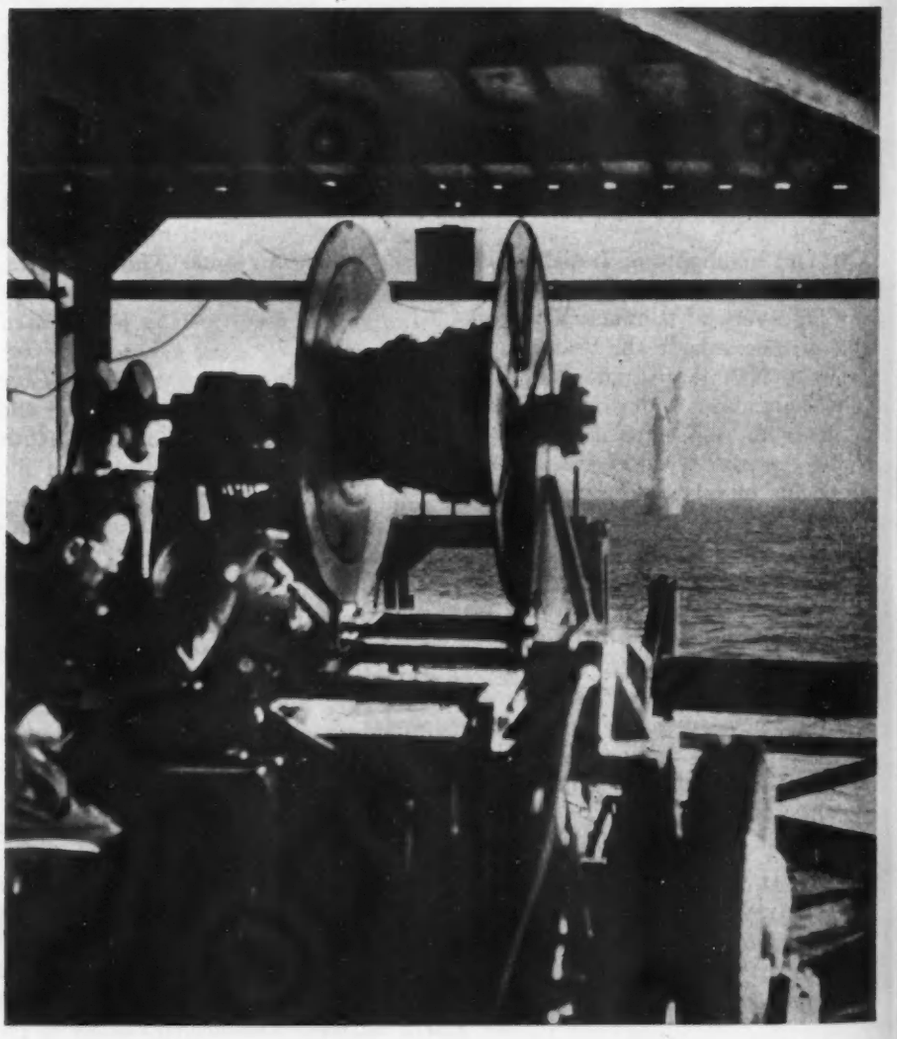
A The Oil & Natural Gas Commission of the government of India will be undertaking detailed exploration work for oil by its own technical personnel. It will also collaborate with private oil concerns for prospecting in areas which did not receive greater attention before and were not fully explored . . . The Commission, with Shri K. D. Malaviya, minister for Natural Resources, as the chairman, is setting up Central Laboratories at Dehra Dun, the headquarters of the commission. It will undertake drilling operations in East Punjab in January, 1957.

Q *The government has announced plans to spend approximately $18 million on a five-year exploration program in a 5000-square mile area near Jaisalmer. Can you reveal any of the*

(Continued on page 196)

MAKING READY—The shooter is about to place the electric detonator into a charge immediately after which it will be thrown overboard.

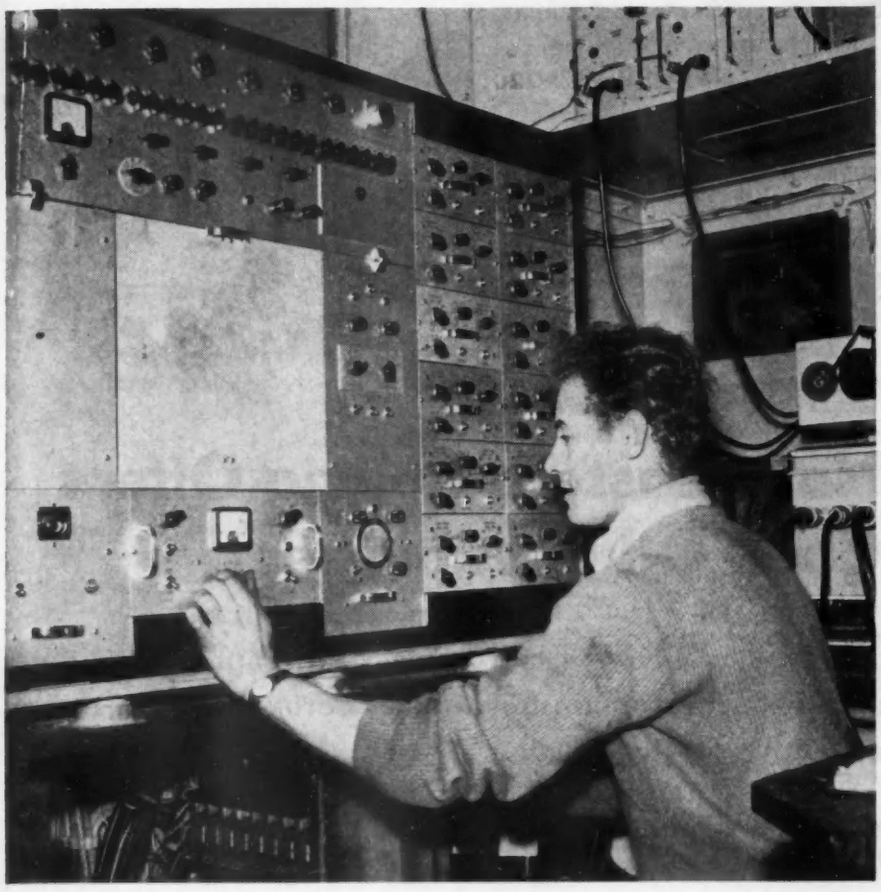
FIRE! This view at the instant of the shot shows the winch operator, left, who, by releasing the brake and allowing the cable to run out, insures that the geophone assembly is stationary in the water at the time of the shot.



BP Is Stepping Up Its Search for Oil Off British Coast

THE FIRST waterborne geophysical survey to be conducted by The British Petroleum Company off the coast of Britain was completed recently off Swanage and Lulworth Cove. It was conducted from the 100-ton converted corvette Seislim, the first British-owned vessel to be specially equipped for this work.

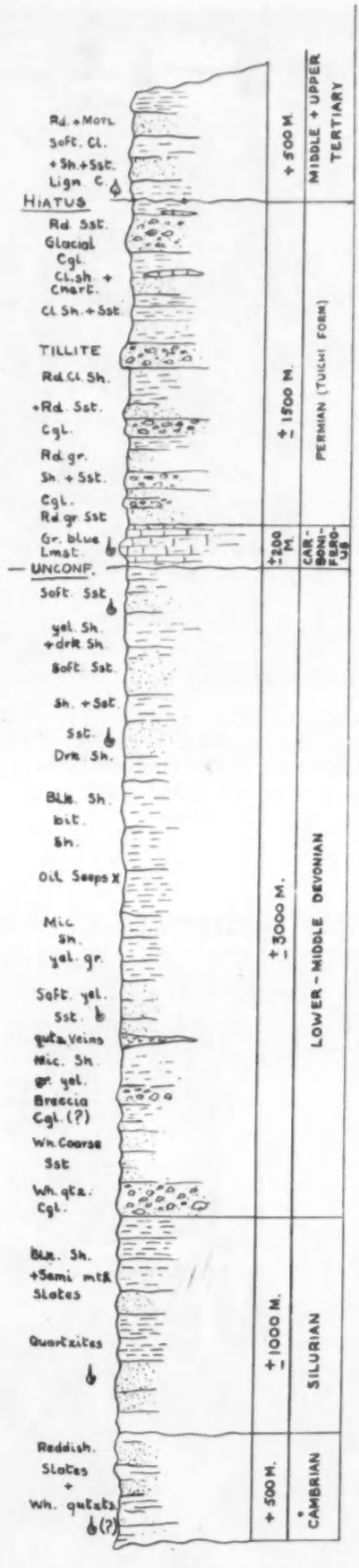
The survey, whose object was to investigate rock formations to a depth of 10,000 feet, consisted of exploding charges of about 17 pounds of high explosive four and a half feet below the surface of the water, along a plotted line. Vibrations transmitted into the sea bed and reflected back from various rock formations were picked up by detectors towed behind the ship on a half-mile long cable. Analyses of the charts will be made at BP's London office.



RECORDING—This survey crew member is checking the recording room instruments.

QUICK LOOK—As a second shot explodes, observers on board the Seislim examine the record obtained from the first shot taken two and a half minutes earlier.

POSITION—While the second mate takes a sextant reading as 12 noon approaches (note clock), the survey operations director checks the ship's position.

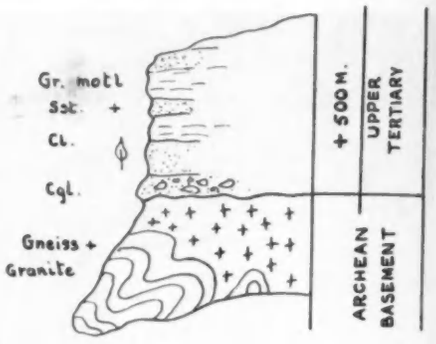


After V. Oppenheim

Generalized Geologic Columns of Northeastern Bolivia. Scale 1:200,000 Meters

FIGURE 1—(left) Northeastern front ranges of the Andes (Bolivia).

FIGURE 2—(right) Lower Beni Valley (Bolivia-Brazil).



Northeastern Bolivia Offers Good Oil Possibilities

Oil seeps, favorable stratigraphic conditions and chances for numerous structures make region attractive for exploration.

By VICTOR OPPENHEIM
Dallas

NUMEROUS OIL SEEPS, favorable regional stratigraphic conditions, and possibilities of numerous structures make northeastern Bolivia—and especially the valley of Rio Beni and the territory of Caupolican—an attractive area for oil exploration. The area was surveyed geologically by the writer in 1943. Other geologists, prior to that time, did considerable work, but published data on this extensive province is limited to reports by Evans (1901-1902) and Welter (1931).

Physiographically the region is characterized by numerous parallel running, sharp and rugged ranges with elevations from 5000 to 8000 feet. These extend in a north-west, south-east direction. Serrania de Bala and Serrania de Jatunari are the more conspicuous ranges. The headwaters of the Beni river and Rio Tuichi, its upper tributary, traverse the region diagonally.

Geologically, Devonian formations are predominant in the western part of the region. Permo-Carboniferous beds occur in the foothill region east of the Devonian belt. Mesozoic formations apparently are lacking in the region and the Paleozoic sediments are overlain by Tertiary red beds, which in places may be confused with the similarly red Permo-Carboniferous formation. Tectonically, the parallel running ranges are actually steeply folded and faulted chains exhibiting a section of intense mountain building.

Physiography. The Front Ranges of the Andes at the upper valley of Rio Beni rise abruptly over the plains for about 3000 feet and then form a succession of extensive ranges up to 9000 feet. These rise successively to the southwest and west of Apolo, and in the high Andes exceed 18,000 feet.

The Front Ranges are drained by a large number of streams and smaller rivers which empty into the Rio Beni or its major tributary, Rio Madidi.

The area between Rurrenabaque, Tumupasa and Apolo is traversed by the main valley of Rio Tuichi, with its many tributaries. This area appears very broken and consists of a series of sharp mountain ranges running in a south-east, north-western direction.

Up to an elevation of about 6000 feet, mountain slopes are covered with dense tropical forests while higher up there prevails a scantier bush vegetation.

The rivers are all torrential, and

during the rainy season almost impassible. Only few foot trails cross this mountain region of Cauplican, which is best approached during the dry months of May, June and July.

Tertiary. Sediments of Upper and Middle Tertiary age are widespread at the foot of the Andes in northeastern Bolivia and occur also in the intermountain valleys west of the Front Ranges.

They consist mostly of red and mottled clays, shales and sandstones. Vegetable fragments and lignite found in the upper part of the section were the only fossils observed in these sediments. Their total thickness could not be measured, but it certainly exceeds 2000 feet. The lower part of the Tertiary formation can be easily confused with similarly looking Permian and Permo-Carboniferous sediments which they overlie transgressively.

The Tertiary beds of the region can be best correlated with the "Terciario Sub-Andino" of southeastern Bolivia, or the Tatarenda formation in the same region. Whether the lower part of these beds grades into Cretaceous was not possible to ascertain. However, positively identified Mesozoic sediments were not observed along this traverse and it is assumed that the Tertiary beds overlie unconformably the Permo-Carboniferous and Devonian formations, where these are in direct contact.

Permian. Immediately west of the high escarpment, a well developed formation of reddish to deep red sandstones and clay-shales appears with interbedded layers of boulder-conglomerates overlying unconformably typical Devonian beds.

Upon a more detailed investigation, this formation could be divided into several members and may correspond to the Bermejo series of southeastern Bolivia. The transgressive contact of the formation, its general character, and abundance of typical glacial tillites, leaves no doubt that it is of Permian or Permo-Carboniferous age and glacial origin.

The conglomeratic boulder-beds consist largely of rocks not found in the region, such as granites, quartzites, phyllites, and other typical basement rocks. In many places these conglomeratic layers form the conspicuous crests of high hills and ranges, evidently representing the hardest and more resistant element of the formation. Although these were not mapped with any precision, the lower tillites apparently consist of smaller pebbles, than the higher ones. The writer thinks it safe to assume the presence of at least three distinct conglomeratic horizons in the formation.

In this part of the Andes the Permian, glacial sediments seem to be much thicker and horizontally more developed than in the south-eastern Front Ranges. The total thickness of the Tuichi formation, as the writer will designate these Permian strata of northeastern Bolivia, is of the order of 4000 feet. Thickness of individual conglomeratic horizons probably is not more than about 20 to 50 feet. The formation consists of red to brick red, sometimes mottled and often crossbedded coarse to fine grained sandstones and clay shales. Fossils were not found during the reconnaissance. These are also lacking in the southeastern Front Ranges.

Chert concretions seem to be characteristic of the upper part of the formation. Although characteristic in the Tuichi area, it is doubted that these could be considered as key beds.

The upper limits of the formation are very inconspicuous and can be easily confounded with the transgressively overlying Tertiary Red Beds that appear in some areas west of the valley of Rio Tuichi. Only continuous field observations make the distinction between these two widely different formations possible with reasonable certainty.

Attempting a correlation of the Caupolican, Permian or Permo-Carboniferous sediments with those observed along the southeastern Front Ranges, as well as the glacial Permian, Itarare beds of southeastern Brazil,[1] it appears obvious that the glaciations in the three regions must have been approximately contemporaneous in time, but formed under different conditions: in marine and near-shore conditions in eastern Brazil, and fluvial, continental conditions in eastern Bolivia.

The fact that no typical varve-clays were found this far in the Bolivian Front Ranges, unlike the frequency of varves in the Itarare of Brazil, is one of the indications of continental character of the Bolivian Permian glaciation as compared to the Brazilian. The great thickness of the glacial Permian in Bolivia, which exceeds that of the Itarare in Brazil, suggests a common source for these sediments, which may be located somewhere between the three areas. The continental character of the glacial sediments in the western part of the glaciated region, may indicate that the Permian ice sheets ended west of the present Front Ranges of Bolivia.

To the east, however, the Permian ice sheets had an outlet into the Atlantic Ocean, which accounts for some of the sediments formed at the expense of floating icebergs. To this difference in origin of the glacial beds in the east and west of the region affected by the Permian glaciation in South America can be attributed also the lack of fossils in the predominantly continental sediments of the Front Ranges, as compared to the poor but evidently present fauna in the Itarare in Brazil.

As petroleum source rocks, the Permian beds of the Front Ranges are negative. Source rocks can no more be expected in the glacial Tuichi formation of Bolivia than they can be in the Itarare of Brazil; the negative value of the latter, as possible source beds, was already pointed out in 1935 (Op. cit.)

Devonian. The northeastern Cordillera Real and the Front Ranges at Caupolican are made up predominantly of Devonian rocks. The Devonian strata observed in the area between Rurrenabaque and Apolo appear to be considerably more developed, and they show more varied and complex facies than the Devonian beds described from the southeastern Front Ranges of Bolivia.

The Devonian strata bordering the Beni plains form escarpments and sharp parallel ranges; however, west of Apolo, Devonian beds of considerable thickness appear to extend as far northwest as the Bolivian-Peruvian border. The topographical ranges coincide with the structural fold and fault patterns and are remarkably parallel over considerable distances. The belt of Devonian sediments joins at its southern end the area of Cochabamba and the southeastern Front Ranges of Bolivia.

The Devonian beds can be divided into several horizons, in the lower part they consist of thick, coarse and hard white, quartzitic sandstones often crossbedded. A white quartz conglomerate made up of well

rounded quartz pebbles, appears at the very base of the formation. The thickness of this lower sandstone horizon exceeds 2500 feet. Upwards the basal sandstone beds become somewhat micaceous, and often acquire a reddish to dark red color. The lowest quartzitic part of the beds strikingly resembles the "Furnas Sandstone" of the Devonian in the Parana Basin of southern Brazil.

Following the massive lower sandstones, the middle part of the Devonian column is made up of soft yellowish, micaceous sandstones, sandy shales, and gray-yellow, thinly laminated shaly sandstones. Siliceous sandstone stringers are frequent in these beds. Higher up, succeeding the sandy shales, there appears a conspicuous member of the formation represented by dark-gray to black thinly laminated clay shales, interbedded with somewhat bituminous shale stringers. These are again repeatedly succeeded by soft, yellowish-gray, micaceous sandstones, and lightly colored micaceous shales. The shales contain frequent lenticular limestone and siliceous concretions. This part of the column could correspond to the "Ponta Grossa Shales" of southern Brazil.

The upper part of the Devonian is made up of massive yellowish-gray sandstone layers of an individual thickness of about 150 feet; these are again repeatedly interbedded by micaceous, mauve colored shales.

The total thickness of the Devonian strata in the northeastern Front Ranges probably exceeds 8000 feet. However, it is complexly folded and faulted and its total thickness could not be adequately measured during the reconnaissance.

Silurian. In the upper Rio Tuichi a succession of black slaty shales interbedded with hard quartzitic sandstones bears, according to Welter, a typical Silurian fauna, which would indicate that Silurian sediments are also present in northeastern Bolivia and may be more widespread than known to be at present.

Cambrian. The oldest rocks known in the region occur to the west of the area in the proper Andean ranges and consist of white hard quartzites and light colored reddish slates. According to Evans, he found near Pata a typical fossil which would indicate a Cambrian age of these rocks.

Tectonics. The structure of the northeastern Andean Front Ranges appears to be very complex. A series of narrow anticlinal folds, accompanied by parallel faults, extends in a southeast northwestern direction, reflected by the rugged topographical features of the region. The Devonian beds are particularly strongly folded and compressed. The main Devonian sedimentary belt, which includes also the Silurian beds partly underlying it, shows evidence of eastward thrusting.

The general tectonic features of this part of the Andes indicate strong and repeated diastrophic movements. The belt of younger Paleozoic sediments is relatively narrow and broken. Similar structural conditions could be expected to prevail for some distance to the northwest and southeast of the area of reconnaissance.

Petroleum Possibilities. The territory of Caupolican has long been known for its numerous oil seeps. Three main groups of oil seeps are located at the foot of the Front Ranges, west of the trail between Rurrenabaque and Ixiamas, in each case about 3 to 5 miles upstream of the Rio Mamuque, Rio Enedere and Rio Tarene rivers.

The oil oozes from Devonian rocks and has a heavy black appearance. The largest of the three seeps is located on the Rio Tarene, where the natives have been known to use it for domestic purposes.

Two other groups of oil seeps are known to occur not far from the trail between San Jose and Apolo rivers, in the Rio Uchupiamono and Rio Kumukaspi. Here again, seeps appear to be associated with Devonian strata, and, although it was not possible to examine the seepages closely due to flooded rivers, these seeps, as well as those already mentioned, are located in fault planes.

Several other seeps have been reported from the upper Rio Tuichi, as well as the southern tributaries of Rio Beni.

Examination of the regional stratigraphic conditions of northeastern Bolivia would indicate that neither the Tertiary beds nor the continental Permian or Permo-Carboniferous sediments could act as source rocks. The Middle to Lower Devonian beds of the region, however, may be considered as source beds.

The petroleum source rocks in southeastern Bolivia are believed to be of Middle Devonian age, and it seems plausible that the source beds of the northeastern Front Ranges are of the same age. A closer study, however, of the Devonian would be indispensable before any final opinion could be formed, but it appears that Devonian sediments of Bolivia are the only source beds in the northeastern Front Ranges.

Although the region is excessively folded and fractured, it is possible that somewhere in the area adequate structures exist with a substantial oil potential. The large oil seeps prove that oil is present.

The narrow character of the folds suggests, however, that the size of the reservoirs would be limited by the sharp configurations of the structures. If production could be expected from the Devonian beds proper, it would probably be limited. The overlying Permian beds, and less probably the Tertiary sediments, could act as reservoirs.

In the Caupolican territory, as in the southeastern Front Ranges of Bolivia, there remain the unknown potentialities of the flat sedimentary belt immediately east of the Front Ranges. At Rurrenabaque, the steeply folded Devonian strata, plunge under the young Tertiary cover. Under this cover, adequate structures could represent conditions favorable for large oil accumulations.

The data of the reconnaissance are of necessity fragmentary and incomplete but, concerning a region as yet mostly unexplored geographically and geologically, this information may assist in furthering future exploratory work.

BIBLIOGRAPHY

Evans, I. W. Expedition to Camplicau, Bolivia 1901-02 Geogr. Journal. London 1903.

Oppenheim, V. Petroleum Geology of Gondwana Rocks of Southern Brazil. Bull. Am. Assoc. Pet. Geol., Vol. 19, No. 12 pp. 1725-1805, 1935.

Openheim, V. Devonian areas of Parana Basin in Brazil, Uruguay and Paraguay. Bull. Am. Assoc. Pet. Geol., Vol. 20, No. 9, 1936.

Oppenheim, V. Bibliografia Geologica de Bolivia. Boletin Sociedad Geografica de La Paz, 1943.

Openheim, V. Diamonds in northern Bolivian Andes. Economic Geology, Vol. 38, 1943.

Oppenheim, V. Mapa Geologico Generalizado de Bolivia y Memoria Explicativa. Bol. Soc. Geol. del Peru, Tomo 17, 1944.

Schlagintweit, O. Reconocimientos San Borja-Huachi-Rurrenabaque, Nov. 1938. La Paz 1939 (Unpublished Report)

Welter, O. El Petroleo de Caupolican en Bolivia y probable extension de sus yacimientos a la montana del Madre de Dios. Bol. Sociedad Geol. del Peru, Tomo 4, Lima 1931.

REFERENCE

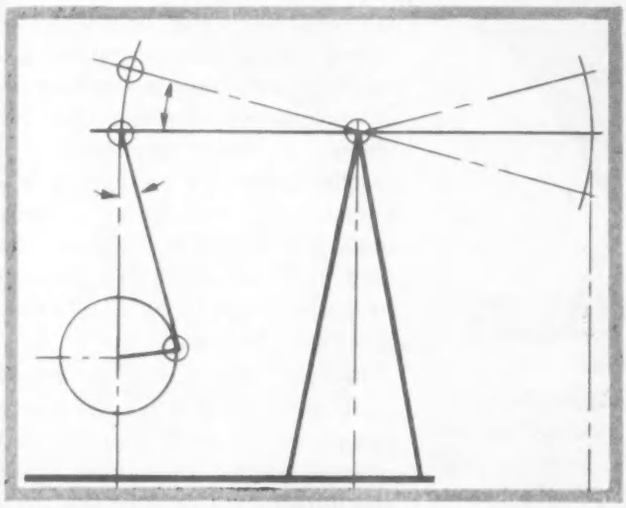
[1] Oppenheim, V. Petroleum Geology of Gondwana Rocks of Southern Brazil, Bull. Am. Assoc. Petrol. Geol. No. 12, pp. 1725-1805, 1935.

ACKNOWLEDGMENT

This article is based on a paper presented by the author at the 20th Geological Congress, Mexico City, 1956.

LUFKIN

THE UNIT WITH THE *highest* G* *factor*



LUFKIN'S
"UNIVERSAL CENTERLINE"
design and correct proportioning of beam working centers and samson post height to stroke length make for . . .

MAXIMUM MECHANICAL and GEOMETRICAL *Efficiency*

GOOD UNIT GEOMETRY IS *MOST IMPORTANT*

- A tall samson post and long working centers minimize pitman and beam angles, resulting in lighter bearing loads and lower friction losses, as well as increased mechanical advantage (lower torque factor) which decreases the torque load on the gears.
- Good unit geometry means smoother performance, lower operating costs, and longer life.

* Factor "G" or Geometrical Efficiency Factor = $\frac{\text{½ Polished Rod Stroke}}{\text{Max. Torque Factor}}$

Lufkin **FOUNDRY & MACHINE COMPANY**

LUFKIN, TEXAS

Branch Sales and Service: Houston • Natchez • Corpus Christi • Lafayette • Dallas • El Dorado • Kilgore • Odessa • Hobbs Midland • Pampa • Wichita Falls • Los Angeles • Bakersfield • Effingham • Casper • Denver • Sidney • Great Bend Oklahoma City • Seminole • Tulsa • New York • Maracaibo, Venezuela

Lufkin equipment in Canada is handled by
THE LUFKIN MACHINE CO., LTD., 9950 65th Avenue, Edmonton, Alberta, Canada, Regina, Saskatchewan, Canada

Suez Action Is Hard Blow To Italian Oil Industry

Nation's fuel oil stocks plummet as petroleum circles seek answer to a too-stringent oil law.

By ANTONIO GIORDANO
World Oil Correspondent

Blocking of the Suez Canal and damages to the pipe lines from the Middle East have put the Italian oil industry and trade in an extremely difficult position.

During 1955, Italy imported 121,376,822 barrels of crude, 2,764,719 barrels of fuel oil and 1,649,801 barrels of motor fuel and aviation gasoline. Of the crude oil imported by Italy during 1955, 63,770,910 barrels came from Banias, Syria, and Tripoli and Sidon, Lebanon; 50,971,242 barrels from the Persian Gulf area through the Suez Canal; 5,713,673 barrels from the Caribbean area and 955,340 barrels from the Black Sea.

From Jan. 1 to Oct. 31, 1956, Persian Gulf imports from Banias, Tripoli and Sidon terminals remained at about the same level. On Nov. 1, 1956, crude oil and products stocks reached the 8,260,000-barrel level. Imports for November and December, 1956, which were put at 13,020,000 barrels, were added to make a total of 21,280,000 barrels.

These stocks, however, are not completely available for domestic use since they include stocks for bunkering purposes and those resulting from refinery processing for customers abroad. These previously committed stocks amounted in January, 1957, to about 2.3 million barrels of gasoline, 580,500 barrels of kerosine, 2,153,250 barrels of gasoil, and 2,670,000 barrels of fuel oil.

Deducting these amounts, the refined products remaining available for domestic consumption amounted to about 3.3 million barrels of gasoline, 620,000 barrels of kerosine, and 13 million barrels of fuel oil.

Normal daily requirements of the Italian market are calculated at: gasoline, 30,430 barrels; kerosine, 5037 barrels; and fuel oil, 183,485 barrels.

Considering these factors, the stock position in Italy as of Jan. 31, 1957, was as follows:

TABLE 1
(In Barrels)

	Gasoline	Kerosine	Fuel Oil
Available for Domestic Consumption in Quarter Ending Jan. 1, 1957	3,281,000	620,775	13,053,130
90-Day Consumption Up to Jan. 31, 1957	2,737,000	453,375	13,162,220
	544,000	167,400	210,590

These figures reflect the urgency in the need for supplying fuel oil. The supply of gasoline and kerosine apparently was sufficient to cover requirements up to Jan. 31, with a sizable balance remaining. Consequently, the government increased the tax on gasoline to cover the higher cost of transporting crude from the Persian Gulf to Italy around South Africa.

Currently, Sicily's Ragusa oil field is producing about 18,000 barres a day. That figure is expected to rise now that the new Ragusa-Augusta pipe line has begun operating. (See Page 200).

However, Italy's output amounts to only approximately 10 percent of its annual requirements of more than 54 million barrels of refined products.

The nation's refining industry is processing from 54 million barrels to more than 61 million barrels of crude annually for customers abroad, and if this business should be shut down or even reduced very much, the nation's economic structure would suffer to a marked degree.

Under these circumstances, rationing in Italy would help only to a degree. With gasoline rationing, of course, would come a resultant drop in government revenue, for taxes amount to about 70 percent of the gasoline price. Too, rationing of oil consumption would lead to serious industrial difficulties because Italy does not have available substitute fuels which exist in France, Germany and Great Britain.

Further, any increase in domestic crude production is hindered by the passage of the new Italian oil bill. All political parties, except the Liberals and Republicans, opposed any amendment offering better terms for private capital company operations. And it is those operations which would more quickly develop the oil potential existing on the peninsula.

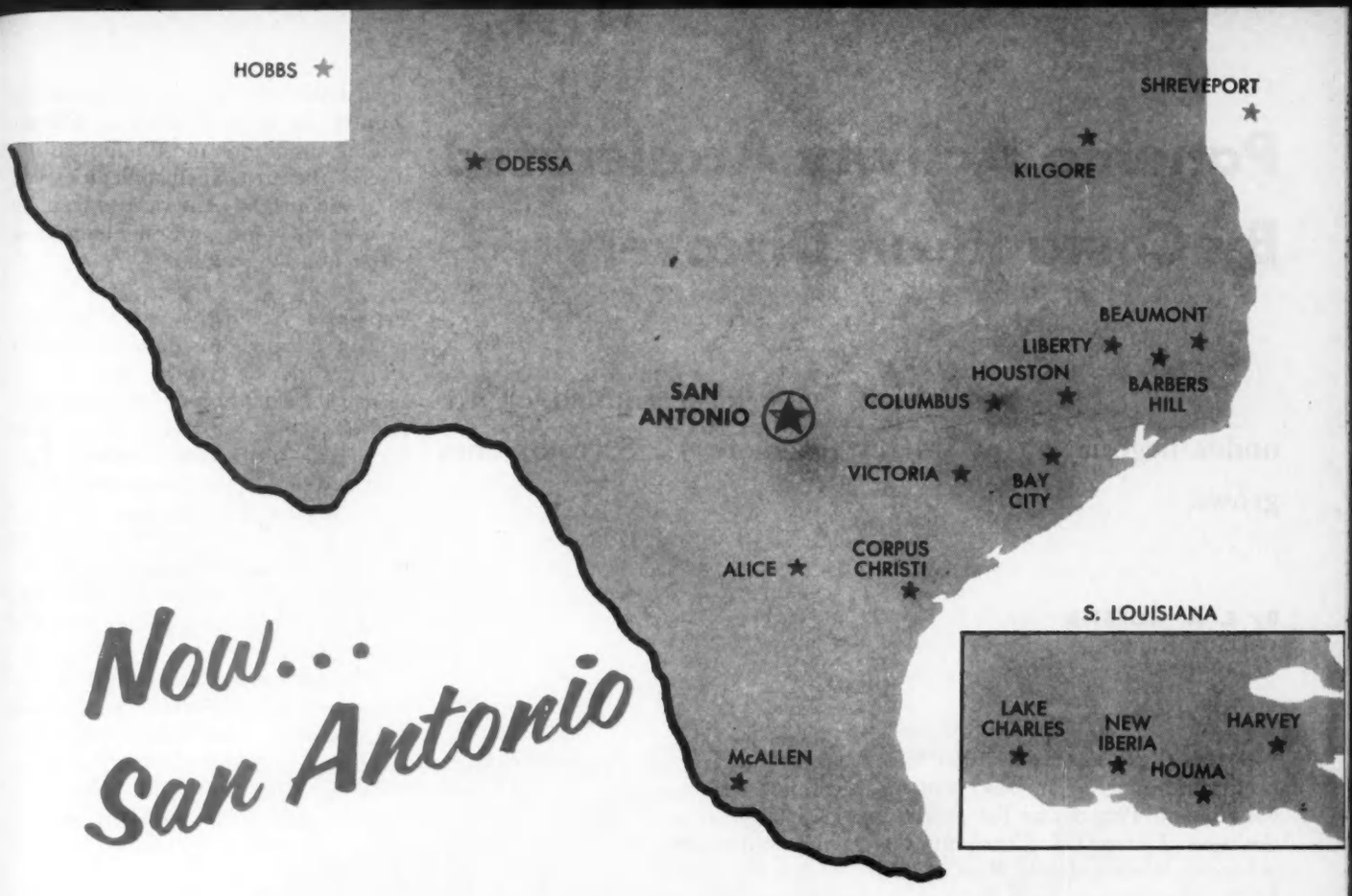
The Alanno oil field, discovered in 1954 by Petrosud's Swan 1 and Swan 2, remains inactive. The government is keeping the two wells sealed. Because of the new and unfavorable oil law, Gulf Oil Corporation which, with Montecatini Co., owned Petrosud, has sold its interest in the company and moved out of the Italian mainland.

Of the 25 oil wells currently producing in Italy, 19 are flowing wells and 6 are pumpers pumping wells. Fourteen of the 25 producers are in the Ragusa oil field in Sicily, and are operated by Gulf Italia Co.

Meanwhile, plans for further drilling and exploration operations are being continued. The Edison Co., Montecatini and Snia-Viscosa have purchased more rotary drilling rigs in the U. S.

But even these operations are being hindered greatly by the uncertainty of the Italian government's oil policy and by the pressure which the Ente

Continued on Page 198



Now... San Antonio

San Antonio has been chosen by the Wilson Supply Company for their nineteenth (19) branch store, to better serve the oil operation in that area.

The new store is well located, being situated at 2223 Southwest Military Drive—Loop 13. It is being stocked with a complete line of well supplies for both drilling and production, and staffed by experienced and competent supply men.

"WHAT YOU WANT — WHEN YOU WANT IT"

MAIN OFFICE and WAREHOUSE - 1301 CONTI ST.

BRANCH STORES

TEXAS: Alice, Corpus Christi, Victoria, McAllen, Bay City, Columbus, Barbers Hill, Liberty, Beaumont, Kilgore, Odessa, San Antonio. LOUISIANA: Lake Charles, New Iberia, Houma, Harvey, Shreveport. NEW MEXICO: Hobbs.

SALES OFFICES

DALLAS SHREVEPORT SAN ANTONIO
TULSA NEW ORLEANS LAKE CHARLES
CORPUS CHRISTI MIDLAND

WILSON SUPPLY CO
HOUSTON, TEXAS

Panama Activity Accelerated By Costa Rican Discovery

Forty concessions have been granted or are under negotiation as interest of more U. S. companies grows.

By E. A. KOESTER
Wichita, Kansas

SOME 40 CONCESSIONS either have been granted or are in process of negotiation in Panama as the result of the new Union Oil Company discovery in eastern Costa Rica. Many U. S. oil companies have entered the play and active geological and geophysical exploration soon will be under way. Many companies are planning thorough exploratory programs so the time of actual drilling activities still is in the future. Concessions in Bocas del Toros and Chiriqui provinces are favored due to their proximity to the Union discoveries.

A. C. Rubel, president of Union Oil Company, has described the Costa Rican discovery at Cocoles 2 as one "of tremendous significance," but many oilmen feel that that company's Cocoles 1, which earlier found oil, also will be successfully completed as a commercial producer.

Little detailed official information has been released but it is known that Cocoles 2 has flowed as much as 1000 barrels per day of 46 gravity oil from Oligocene limestone at about 4950 feet. Water problems have hampered completion of both wells. Encouraging shows of oil have been found in a "Texas offset," Union's Yorkin 1, located just across the line in Bocas del Toros province, Panama.

Discovery of oil in a limestone sequence interbedded with igneous intrusions, a condition found in the Cocoles wells, has removed one of the bugaboos to oil and gas exploration in the Isthmian region. Previously, the occurrence of so many types of igneous rock, both intrusive and extrusive, within the sediments of Central America has caused some geologists to look upon other areas as more favorable oil hunting ground.

Other factors that have caused exploration managers to look askance at Panamanian prospects have been the slight knowledge of the geology of the country, its tropical climate, difficult drilling conditions and the faulted nature of the area. Such difficulties will be overcome by American ingenuity here as they have been elsewhere throughout the world.

Previous Activities. First exploration in Panama was done by Sinclair affiliates during World War I. Oil seepages from Miocene beds had been known about for many years near Garachine in Darien province, Panama and on Uscari Creek and at Uruchico in the Talamanca valley of Costa Rica. The latter localities are near the Union wells. Ten wells have been drilled in Panama of which five are reported to have found shows of oil or gas.

The deepest test was drilled by Sinclair and Cities Service in 1949 at No. 1 Corotu, near Puerto Armuelles, Chiriqui. It passed through a major fault at 7785 feet and below that depth is thought to have been in fault gouge material to 9715 feet, its total depth.

Previously, Sinclair through the years had drilled three wells on Colombus Island in Bocas del Toros province on the Caribbean side of the country. All had drilling difficulties, including heaving shale, and the deepest went to 8621 feet. Gulf Oil Corporation subsidiaries found some shows in wells drilled in Darien province. A Texas Company affiliate abandoned a cable tool test in 1925 north of David, Chiriqui province, at 3862 feet after a long fishing job. These companies have withdrawn from the country.

Geological Conditions. Exploration for oil in Panama should be confined to the basins on both sides of the Continental Divide which runs the length of the country. Naturally, the lowest part of the Divide is found at the Panama Canal, but in Western Panama, it has an average height of 5000 to 6000 feet. The highest volcanic peak, El Baru, on the south side of the Divide, towers to 11,410 feet.

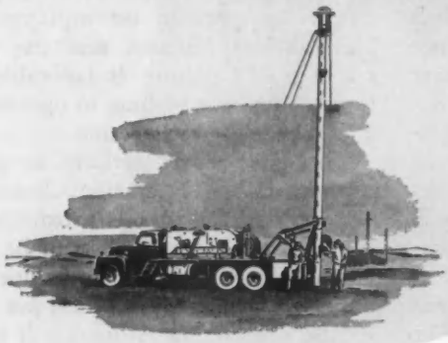
In Western Panama, sedimentary basins extend into Bocas del Toros and Chiriqui provinces from adjoining Costa Rica. These areas are receiving most attention at this time. Other basins are found in the provinces to the east and a large basin extends from the Canal Zone through

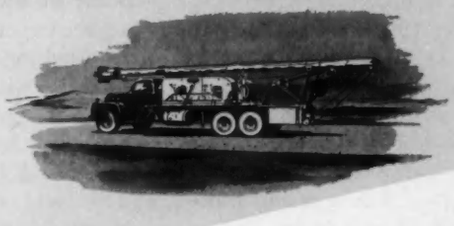
About the Author

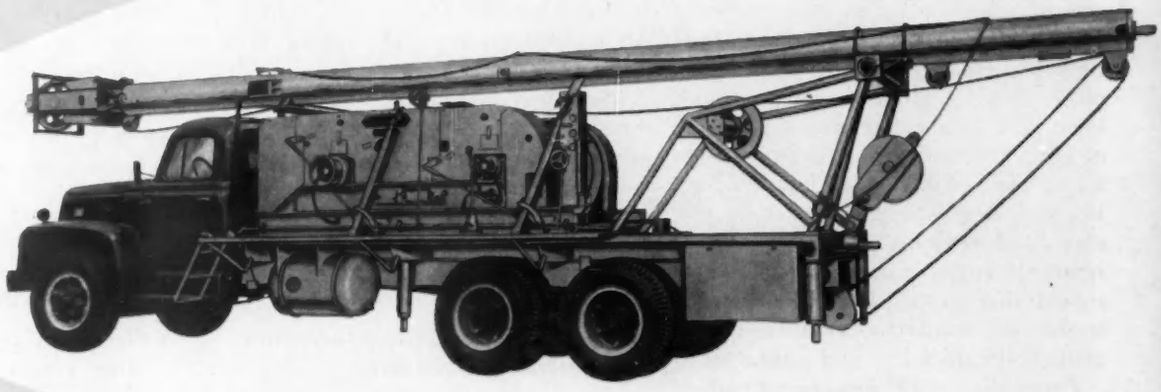
Edward A. Koester, consulting geologist, Wichita, Kan., is a past president of the American Association of Petroleum Geologists (1954). He is a graduate of Friends University, Wichita, Kan., and the University of Missouri. He also studied geology at the University of Colorado. He has been associated with a number of independent oil companies since 1929 and also worked with the U.S. Geological Survey. Throughout his career he has contributed scientific articles to a number of organizations, publications and trade journals. A consulting geologist and oil producer since 1947, he has been very active in the Society of Economic Paleontologists and Mineralogists and the AAPG.

SPEED

ON THE JOB... BETWEEN JOBS...







that's cardwell's model K 203

Because it's designed for faster moving . . . faster rig-up and tear-down . . . faster on the job performance, use of a Cardwell MODEL K203 Double Drum Servicing Hoist results in hard-money savings! It combines rugged-duty construction with lightweight mobility . . . is depth rated to 9,000 feet for well servicing, swabbing, etc. . . . and is equipped with a Cardwell 140,000 pound capacity telescoping pipe mast as standard equipment . . . telescoping stinger available.

Located well forward to provide ample rear deck storage for tools, blocks and other equipment, the hoist features a fully enclosed oil-bath input drive. Remote control is provided for 5 forward and 1 reverse speed, gear transmission and Cardwell Flex-Disc air friction clutches are used throughout.

Easy to handle—on the road or in the field—Cardwell's K203 *speeds* the job—to save time and dollars!

cardwell MANUFACTURING COMPANY P. O. BOX 2001, WICHITA, KANSAS

A-9-57

Panama and Darien provinces into Colombia. Smaller basins that have received some attention in the past are found in Darien province and will be subjected to further study.

Prospectors of oil in Panama will expect to find it in Tertiary beds. Cretaceous fossils were reported from northwestern Panama many years ago, but later workers have failed to find Cretaceous rocks in place.

The geology of the Canal Zone has been worked out fairly well by a number of geologists, but the only work that has been published on Western Panama is contained in a recent bulletin by Robert A. Terry[1].

Subdivisions of the Tertiary rocks have not been determined to the same degree that these strata have been broken down in California or the Gulf Coast region. The Isthmian region, which includes a broad shelf on both sides of the present coastlines, has been poking its head above sea level off and on for some time in the geologic past. It also has been the locale of considerable volcanic activity, and all of the sediments are interbedded to some degree with tuffs, agglomerates and breccias. Average thicknesses of formations cannot be assigned due to possible repetition of section by faulting and to rapid changes in thickness and character.

Since fractured Oligocene limestone has been found productive in nearby Costa Rica, beds of that age probably will be considered the primary objective of tests in Panama. However, in many parts of the country, thick deposits of Miocene and Eocene age are known. These also will be the objects in the search for oil.

Shows of oil and gas, particularly in Miocene rocks, have been found in several parts of the Isthmian region, and these beds will not be ignored. When the stratigraphy of the country is thoroughly worked out, no doubt additional potential producing zones will be uncovered in the thick Tertiary sediments whose details are now unknown.

Operating Conditions. Compared to those parts of the United States where oil is produced in large quantities, drilling conditions in Panama will be difficult and expensive. Some areas are much worse than others. Jungle conditions, lack of roads, great distances from bases and supply stores and the "rainy season" will all add to the grief of the prospector. But these problems have been met and resolved by American oilmen all over the world. In some parts of Panama, such as coastal Chiriqui, road conditions are much better than in others and topographic relief is slight. Such areas are particularly favored for geophysical operations.

Some of the worst drilling difficulties were experienced when cable tools were used on the early wells. Since most wells will be drilled with rotary tools, these problems have been minimized. But, heaving shale and problems caused by landslips and faults will be met.

U. S. prospectors in Panama will be working under political and economic conditions rarely found in foreign exploration today. Probably most important is the fact that they will be operating under a safe, stable and friendly government in a country whose economy is closely tied to that of the U. S.

Moreover, the terms of the concessions, which generally cover a large area, are reasonable. Adequate time is allowed for geological and geophysical work to be done before drilling requirements must be met. Areas that need further investigation may be retained by payment of reasonable rentals. There are no exorbitant royalties or other burdens. "Conservation clauses" are written into the terms of the concession. There are no import duties on material or equipment brought into Panama and the corporation tax picture is favorable to those companies wishing to operate as a Panamanian corporation.

The prospective territory is adjacent either to the Pacific Ocean or Carribean Sea and this proximity to cheap water-born outlets will be advantageous when and if production is found. Moreover, oil found on the Pacific side of the Isthmus will have a distinct advantage in West Coast markets over South American crude that must pay a heavy toll in passing through the Canal.

REFERENCES

[1] Robert A. Terry, 1956, A Geological Reconnaissance of Panama: California Academy of Sciences, Occasional Paper No. 23.

Indian Minister Evaluates Oil

Continued from Page 185

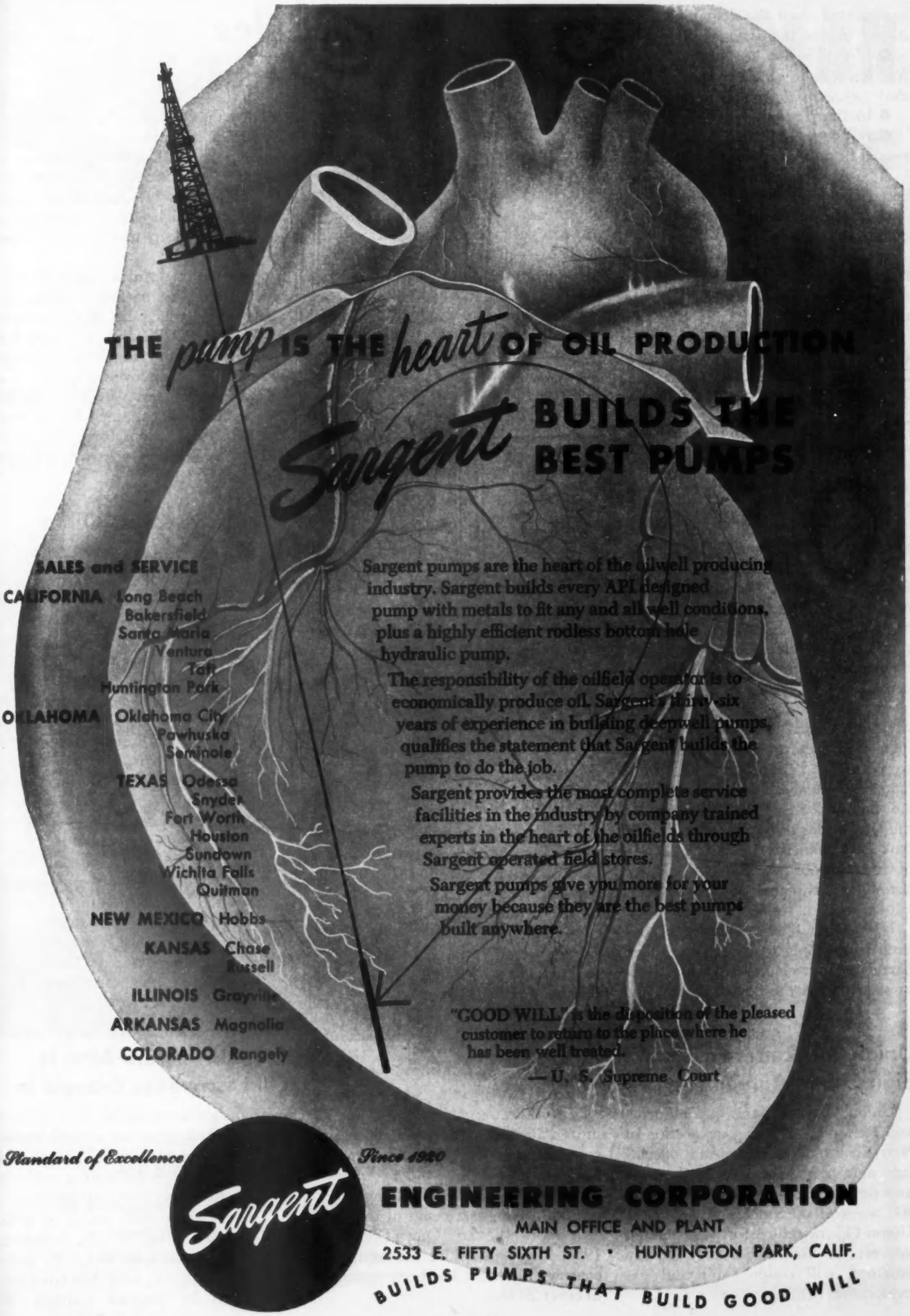
specific details concerning the drilling and exploration program?

A It is proposed to undertake during the Second Five-Year Plan period exploration operations in the following regions:

1. Assam: Formation of a joint enterprise of the government of India and the Assam Oil Company for exploration, development, exploitation, and transport of crude oil.
2. Punjab: The Oil & Natural Gas Commission has undertaken to prove the thickness of sediments in this region . . . (by) . . . interpretation of the structures and trends of the sedimentary formations . . . (through) . . . geological, geophysical and structural drilling operations, and is undertaking deep drilling in favorable sites.
3. Rajasthan: Geological, geophysical (seismic, gravity and aeromagnetic) work and preliminary drilling in parts of West Rajasthan by the Oil & Natural Gas Commission.
4. Ganga Basin: Aeromagnetic and other geophysical work in parts of the Ganga Basin to be followed by drilling.
5. West Bengal: The Standard Vacuum Oil Company of New York, with the approval of the government of India, has started geological and geophysical investigations in parts of West Bengal. Drilling will be undertaken after the geological and geophysical data are analyzed.
6. Cambay-Cutch & East Coast: Preliminary geological, geophysical and structural drilling operations will be undertaken by the Oil & Natural Gas Commission in parts of Cambay-Cutch and East coastal regions.

Q *What is India's current domestic demand, and how much of it is furnished by imports from, primarily, the Middle East and Indonesia. What change is expected in demand in the foreseeable future?*

A Current demand for crude oil is on the order of 3.6 million tons (1 ton equals approximately 7 barrels) per year, out of which nearly 89 percent



THE *pump* IS THE *heart* OF OIL PRODUCTION

Sargent BUILDS THE BEST PUMPS

SALES and SERVICE

CALIFORNIA Long Beach, Bakersfield, Santa Maria, Ventura, Taft, Huntington Park

OKLAHOMA Oklahoma City, Pawhuska, Seminole

TEXAS Odessa, Snyder, Fort Worth, Houston, Sundown, Wichita Falls, Quitman

NEW MEXICO Hobbs

KANSAS Chase, Russell

ILLINOIS Grayville

ARKANSAS Magnolia

COLORADO Rangely

Sargent pumps are the heart of the oilwell producing industry. Sargent builds every API designed pump with metals to fit any and all well conditions, plus a highly efficient rodless bottom hole hydraulic pump.

The responsibility of the oilfield operator is to economically produce oil. Sargent's thirty-six years of experience in building deepwell pumps, qualifies the statement that Sargent builds the pump to do the job.

Sargent provides the most complete service facilities in the industry by company trained experts in the heart of the oilfields through Sargent operated field stores.

Sargent pumps give you more for your money because they are the best pumps built anywhere.

"GOOD WILL" is the disposition of the pleased customer to return to the place where he has been well treated.

— U. S. Supreme Court

Standard of Excellence *Since 1920*

Sargent

ENGINEERING CORPORATION

MAIN OFFICE AND PLANT

2533 E. FIFTY SIXTH ST. • HUNTINGTON PARK, CALIF.

BUILDS PUMPS THAT BUILD GOOD WILL

For more data on advertised products, use Readers' Service Cards, last page.

is imported. And the demand is constantly on the increase.

Q *Where and when are the three Russian rigs (recently ordered by India) expected to be put to work?*

A In Punjab.

Q *When are the first three rigs expected to arrive in India from Russia?*

A In April, September and November, 1957.

Q *Is Russia going to send technicians to operate the rigs?*

A Yes. One Russian drilling expert has already arrived in India, and others are expected to arrive with the rigs. —**The End**

Suez Action Blow to Italy

Continued from Page 192

Nazionale Idrocarburi, the government oil agency, is putting on the Sicilian Regional Government to create a government oil monopoly in Sicily.

Of interest to Italian oil circles awaiting the outcome of this effort is the offer made to ENI by The British Petroleum Company to furnish British oil experts to carry out both exploration and drilling operations in the Italian peninsula and in Sicily. The offer had not been accepted.

In connection with the Italian oil situation, Genoa and Venice business quarters were urging the government to permit acceptance of the offer from Rumania and Russia to supply 8.8 million barrels of crude oil, 1.6 million barrels of fuel oil and 700,000 barrels of refined products. A portion of these imports would be paid for through advances of Switzerland banks.

Up to now, import licenses have been issued only to cover 3.5 million barrels of petroleum products to be imported from the Soviet Bloc.

—**The End**

Union Oil, Reiter-Foster Sign Cuban Agreement

Union Oil Company of California and Reiter-Foster Oil Corporation of New York have signed a final operating agreement for the exploration and development of more than 900,000 acres of oil concessions in Cuba. Union Oil, in return for a 50 percent interest in Reiter-Foster's Cuban holdings, will conduct oil and gas exploration drilling.

Burma Oil Schedules First Postwar Wildcat

Preparations for drilling a deep test at Ondwe, in the Magwe district of central Burma, was under way as The Burma Oil Company (1954) Ltd. began moving stores, building materials and machinery to the site from Chauk and Rangoon.

The initial job was the construction of unloading facilities and a stores area at Myingun, on the east bank of the Irrawaddy River about 16 miles from Ondwe. Installation of a water pumping station, road building and erection of camp housing were to follow.

With the program scheduled to begin early this year, a shallow well in search of natural gas was scheduled to be drilled first. If found in sufficient quantities, the natural gas will be used as fuel for boilers of the steam rig which will be brought in to drill the deep test to 10,000 feet or more.

Presence of natural gas at Ondwe was proved by earlier drilling. Six wells were drilled by BOC between 1912 and 1927, and through gas sands were found no promising crude deposits were discovered.

The Ondwe test was described as BOC's first wildcat since World War I. Ondwe operations form the initial step in the search for a new Central Burma oil field.

International Egyptian Buys Camdrill's Two Drilling Rigs

Southern California Petroleum Corporation has announced that its subsidiary, Camdrill International, Inc., has completed negotiations with International Egyptian Oil Company whereby International has taken over Camdrill's two large drilling rigs in Egypt.

Camdrill has been paid in full for the rigs under the force majeure clause in its contract.

Drilexco To Increase Its Contract Drilling Abroad

Drilling and Exploration Company, Inc., plans to expand its contract drilling operations in foreign countries in keeping with the increase of overseas operations.

Working through wholly-owned subsidiaries, Drilexco has conducted its operations in Brazil, Oman (Arabia) and Iran. Recently, work was expanded in Turkey where one rig was put in operation with another scheduled to follow.

Drilvo, a Dutch subsidiary in which Drilexco owns 51 percent interest, was negotiating to move a drilling rig into Pakistan. Drilvo is operating contract rigs in Holland, France, Sicily and Nigeria.

Additional contract drilling is expected in Iran as a result of the Qum discovery (World Oil, December, 1956, Page 206), and the company's contract in Brazil has been expanded to cover 20 rigs.

Pemex Discovers Oil In Jurassic Near Tampico

Discovery of oil in Jurassic strata in commercial quantities has been described by Petroleos Mexicanos, government oil monopoly, as the most important discovery in recent years.

The discovery well was drilled 20 miles north of Tampico in an area named "Constitutions of 57 and 17." The oil bearing Jurassic strata were located at 7500 feet, and, according to Pemex technicians, the discovery signifies an enormous increase in the nation's crude reserves. It was expected that nearby Panuco field, hitherto considered exhausted, would be restored to production at lower depths.

Crude was being transported to Tampico terminal by tank cars, but a 20-inch pipe line was expected to be completed shortly.

2 Southwestern Alberta Oil Discoveries Brought In

Two significant oil discoveries have been chalked up in an area of southwestern Alberta where there had been little encouragement previously despite extensive wildcat drilling.

The discovery wells are Texaco-C. and E.-High River A-1-25, drilled by Texaco Exploration Co., 30 miles south of Calgary, and Sinclair-Dahl 1, drilled by Sinclair Canada Oil

ASK THE MAN IN THE RED CAR

for fast, effective answers to your emulsion, corrosion, scale and similar treating problems

Whenever or wherever you see the Tretolite "Man in the Red Car" you are looking at an assistant for many of your field problems.

Not only is the Tretolite Field Engineer strategically located for your quick availability—he is adequately trained and equipped to recognize and effectively cope with most of your treating problems *right then and there!* His rear-of-car laboratory makes it possible for him to render on-the-spot analyses and suggested solutions for your treating problems.

Further, he is an important link in a well-forged, nationwide chain of men and facilities. He knows that he, in turn, is backed by the extensive research and technical experience of the Tretolite Company—always ready to advise, develop, or even send technical men into the field when necessary.

Why not present your very next field problem to

THE MAN IN THE RED CAR!

Chemicals and Services for the Petroleum Industry

DESALTING • DEMULSIFYING • CORROSION PREVENTING
SCALE INHIBITING • FUEL OIL ADDITIVES
WATER DE-OILING • PARAFFIN REMOVING
METAL CONDITIONERS

TF-57-1

TRETOLITE
COMPANY

A DIVISION OF PETROLITE CORPORATION

369 Marshall Ave. • St. Louis 19, Mo.

5515 Telegraph Rd. • Los Angeles 22, Calif.

For more data on advertised products, use Readers' Service Cards, last page.

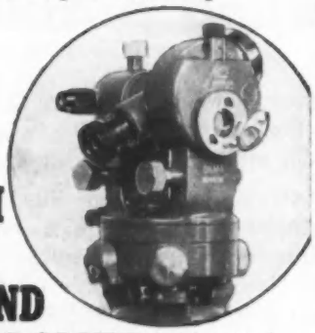
*IN TEXAS

...AND THE WORLD OVER

KERN SURVEYING INSTRUMENTS

*The Bridge Division of the State of Texas Highway Dept. uses Kern Instruments

WORLD FAMOUS FOR
Working Speed
Operational Simplicity
Accuracy & Economy



DKMI TEN SECOND THEODOLITE (with optical micrometer)

- Exceptional portability and precision.
- Readings automatically ... AT A GLANCE.
- Direct reading to 10". Estimation to 1". Average working accuracy —3-4 secs.
- Can be used with electric lighting unit for night work.

KERN CENTERING TRIPOD

Unique—a Kern first! Centers instruments in seconds with remarkable accuracy. Assures exceptional stability with ball-and-socket head, supporting instrument coupling.

★

Write for Brochure DK 518 - 8

PROMPT, RELIABLE SERVICE
FACTORY TRAINED PERSONNEL

Kern SWISS

The FINEST in SURVEYING EQUIPMENT

KERN INSTRUMENTS INC.
120 Grand St., White Plains, N.Y.

Company 65 miles south of Calgary.

The High River well rated an initial potential of 326 barrels daily of light oil. Production is from the top porous section of the D 1 Devonian formation. The D 1 was topped at 9622 feet and perforations were set between 9625 feet and 9638 feet. Followup drilling was expected to get under way shortly.

The Sinclair well was completed on pump with a calculated potential of 120 barrels of light oil daily. Production is from the Colorado section of the Cretaceous between 5506 feet and 5532 feet.

Oil Discovery Reported In Northeastern Syria

J. W. MenHall and Associates reportedly struck oil at Karatchok, located in extreme northeastern Syria, about 37 miles northwest of the Ain Zalah oil field in nearby Iraq. While commercial production was definitely indicated, full evaluation of the find will take a long time.

The well had reached 6780 feet in Cretaceous beds. A drillstem test was being taken at this depth and plans to take the well to 6850 feet or deeper were in effect. Circulation was lost upon penetration of the top of the Cretaceous, and it was hoped that about 90 feet of effective fractured limestone pay exists between 6500 and 6780.

The surface structure on which the well was being drilled is 15 miles long and five miles wide. Whether production will be extended over the entire structure was not known. But there had not been any salt water found in the discovery well at the depth reported.

How to Get Your 1956 Editorial Index

A complete editorial index covering all issues of WORLD OIL published during 1956 has been compiled and bound separately in convenient pamphlet form. It will be sent free to all subscribers requesting copies.

To get your copy, address orders to the Librarian, Gulf Publishing Company, Post Office Box 2608, Houston 1, Texas. Or if you prefer, you can use the convenient Readers' Service Blue Postcard on the last page of this issue. Just check the square indicated. Fill in your name and address. Drop the postage-paid card in the mail and the index will be sent you.

Act now. The supply is limited.

Gulf Dedicates Its 14-Inch Oil Pipe Line in Sicily

Gulf Oil Corporation, which recently halted operations in Italy following the parliamentary approval of a new peninsular oil law, has announced that the new Ragusa-Augusta crude pipe line in Sicily has been formally dedicated.

The 14-inch line connects Gulf Italia's production at Ragusa, now at the 18,000-barrel-a-day level, with the RASIOM refinery on the east coast of the island. Rated daily capacity of the refinery is 35,000 barrels.

Gulf expects to accelerate its exploration activity in Sicily, in addition to raising Ragusa production which previously had been hampered by congested transportation facilities for the crude.

Easing of the transmission situation favoring rise of crude production and the increased exploratory effort in Sicily is in sharp contrast to the situation in Italy. The new Italian oil law, supported by nationalistic socialist groups, is discouraging to private investment, and Gulf Italia sold its interest in Petrosud.

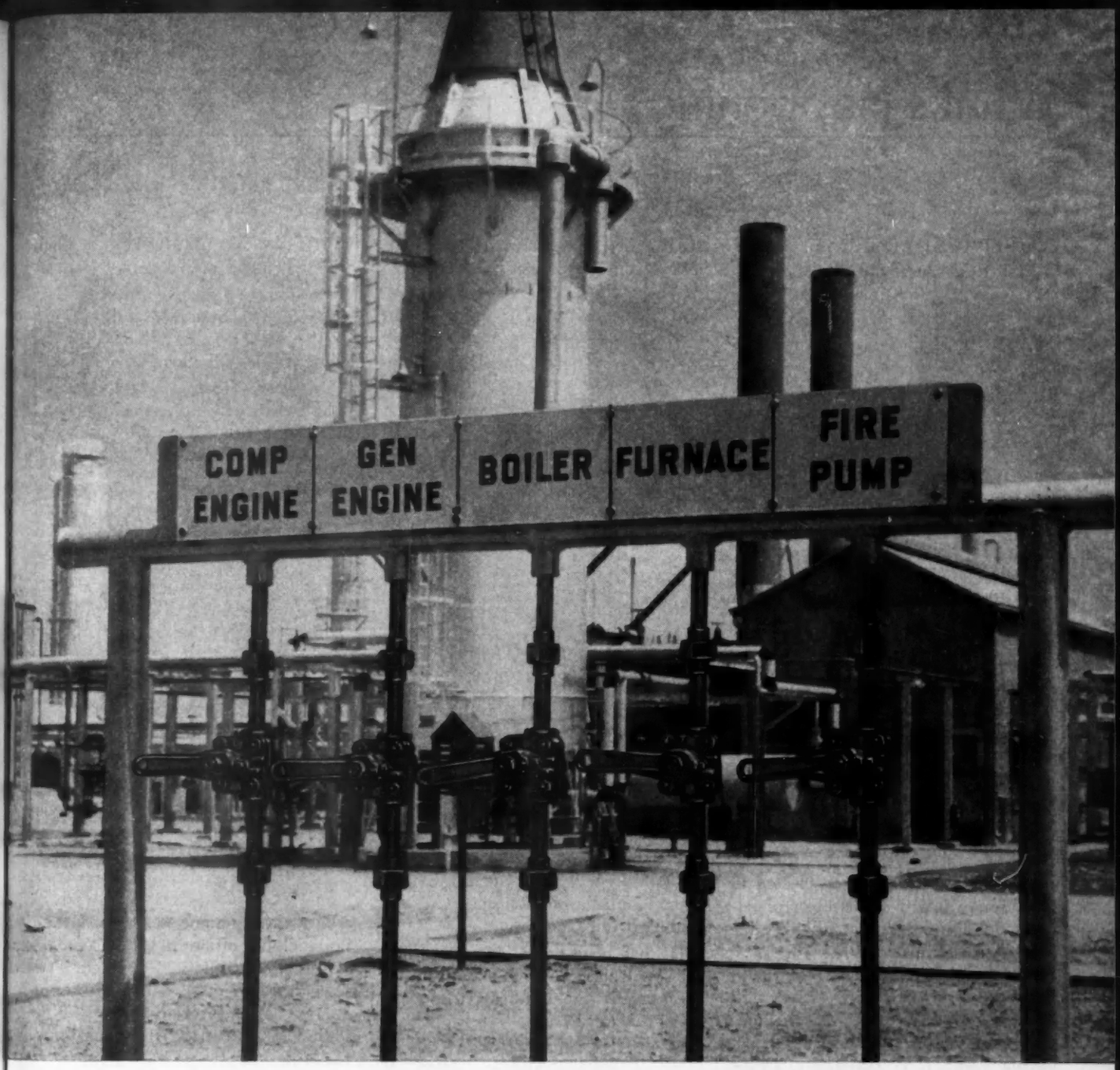
International's Panamanian Interest Is Extended

International Oil and Metals Corporation is adding to its extensive oil properties in Panama an approximate 2 percent overriding royalty interest in a new 700,000-acre concession in the provinces of Panama and Bocas del Toro in Panama. The Bocas del Toro acreage is adjacent to Union Oil Company's operations there.

International will acquire its new interest as part of its price for drilling a qualifying well for the holders of the master concession. International's portable drilling rig and equipment have been in Panama since late summer for exploratory operations on its own properties.

Part of the new concession is in Bocas del Toro province, where Union is now drilling in a follow-up to its 1000-barrel-a-day discovery well across the border in Costa Rica.

International already has a 90 percent interest in another 700,000-acre concession partly in Bocas del Toro province and an operating agreement on a concession of approximately 1,165,000 acres in Darien province.



THE LITTLE VALVES WITH THE BIG JOB

The Rockwell-Nordstrom valves on the emergency shut-off manifold above have a really big job. On their absolute dependability rests millions of dollars of capital investment.

Why do you so often see Rockwell-Nordstrom lubricated plug valves in the really vital spots? The answer: users know they provide *both* essentials of a truly dependable valve. They won't stick or gall—pressurized lubricant readies the plug for *instant, quarter-turn operation*. And, equally important, they assure *positive shut-off*.

These same important advantages—instant operation and positive shut-off—also make Rockwell-Nordstrom valves your best investment for practically every flow control need. And they cost no more to buy, often less, than ordinary valves. For complete details, call your supplier or write Rockwell Manufacturing Company, Pittsburgh 8, Pa. *Canadian Valve Licensee:* Peacock Brothers Limited.

ROCKWELL-Nordstrom VALVES

Lubricant Sealed For Positive Shut-off

What's Happening

AMONG WORLD OIL MEN

JOSEPH L. HARGROVE, partner in Hargrove Oil and Gas Company, Shreveport, La., has gone to Australia to supervise drilling operations for a new company. He will be associated with the South Pacific Company, Ltd., an Australian corporation, as vice president and director. The new firm plans to conduct drilling operations in the Mantuan Downs concession, which comprises 7000 square miles in Queensland, about 450 air miles from Brisbane.

Joseph L. Hargrove

Associated with Hargrove in the Australian firm is R. R. Herring, president of Fish Service Corporation, Houston, who will serve as president and will remain at the Houston office of the South Pacific Company.

•

The following have been elected to the 25-man board of directors of Alberta division of the Canadian Petroleum Association:

G. L. McMahon, Pacific Petroleum Limited; E. C. Babson, Union Oil Company of California; A. E. Feldmeyer, Canadian Superior Oil of California Ltd.; J. P. Gallagher, Dome Exploration (Western) Ltd.; G. H. Galloway, Stanolind Oil and Gas Company; W. H. Hohag, Banff Oils Ltd.; Dr. W. C. Howells, McColl-Frontenac Oil Company, Ltd.; C. A. Nabors, Parker Drilling Company of Canada Ltd.; N. W. Nichols, Great Plains Development Co. of Canada, Ltd.; T. Nitescu, Canadian Fina Oil Ltd.; J. G. Spratt, Triad Oil Co. Ltd.; S. Steward, Richfield Oil Corporation; and J. B. Webb, Canadian Oil Companies Ltd.

•

JAMES A. TONG has been elected president of Socony Mobil Oil Company de Venezuela, replacing JOHN C. CASE, a director of the parent company and its vice president for producing operations. Tong was named chief geologist in Venezuela for Socony in 1939, and became manager of Socony's operations in Colombia in 1943, returning to Venezuela as general manager in 1948. He became executive vice president there in 1949. H. R. MOORMAN is the new executive vice president of Socony Mobil de Venezuela. Moorman has held high positions in the geophysical department of Socony companies since 1939.

•

MARTIN H. MITCHELL has been named general manager of Tidewater Oil Company's operations in Turkey, succeeding JAY T. GIST, who has been transferred to Beirut, Lebanon. Mitchell will direct oil exploration for Tidewater on 2.5 million acres in Turkey held jointly with The Atlantic Refining Co. and Seaboard Oil Company.

Martin H. Mitchell

He has been with Tidewater since 1937 and has been manager of the Western division Land department at San Francisco, Calif.

•

J. HERBERT SAWYER of Esso Standard Oil, S. A. (N. J.) has been elected president of the Petroleum Club of Havana, Cuba, for a one year term. Others elected are:

For one year terms: Vice president, HENRY L. BRANDON, Union Oil Company of California; secretary, DR. FERNANDO FREYRE DE ANDRADE of Freyre, Andrade y Montalvo; vice secretary, DR. EMILIO ARANGO of Nunez Mesa y Machado; treasurer, THOMAS RITTER, Sun Oil Company; assistant treasurer, DR. JORGE FAZ VEGA, The Atlantic Refining Co. of Cuba.

Directors elected included:

Three-year terms: R. C. FREE, Cuba California Oil Company, and JAMES W. VANDERBEEK, Cuban Stanolind Oil Company.

Two-year terms: ROLF ENGLEMAN, Esso Standard Oil, S. A. (N. J.), and PAUL J. GRIFFITHS, White Eagle Oil Company.

One-year terms: HARRY W. WASSALL, consulting geologist, and EARL COPELAND, JR., associate editor, Cuban Petroleum News Digest.

•

Herbert J. Weeks

Samuel M. Vauclain

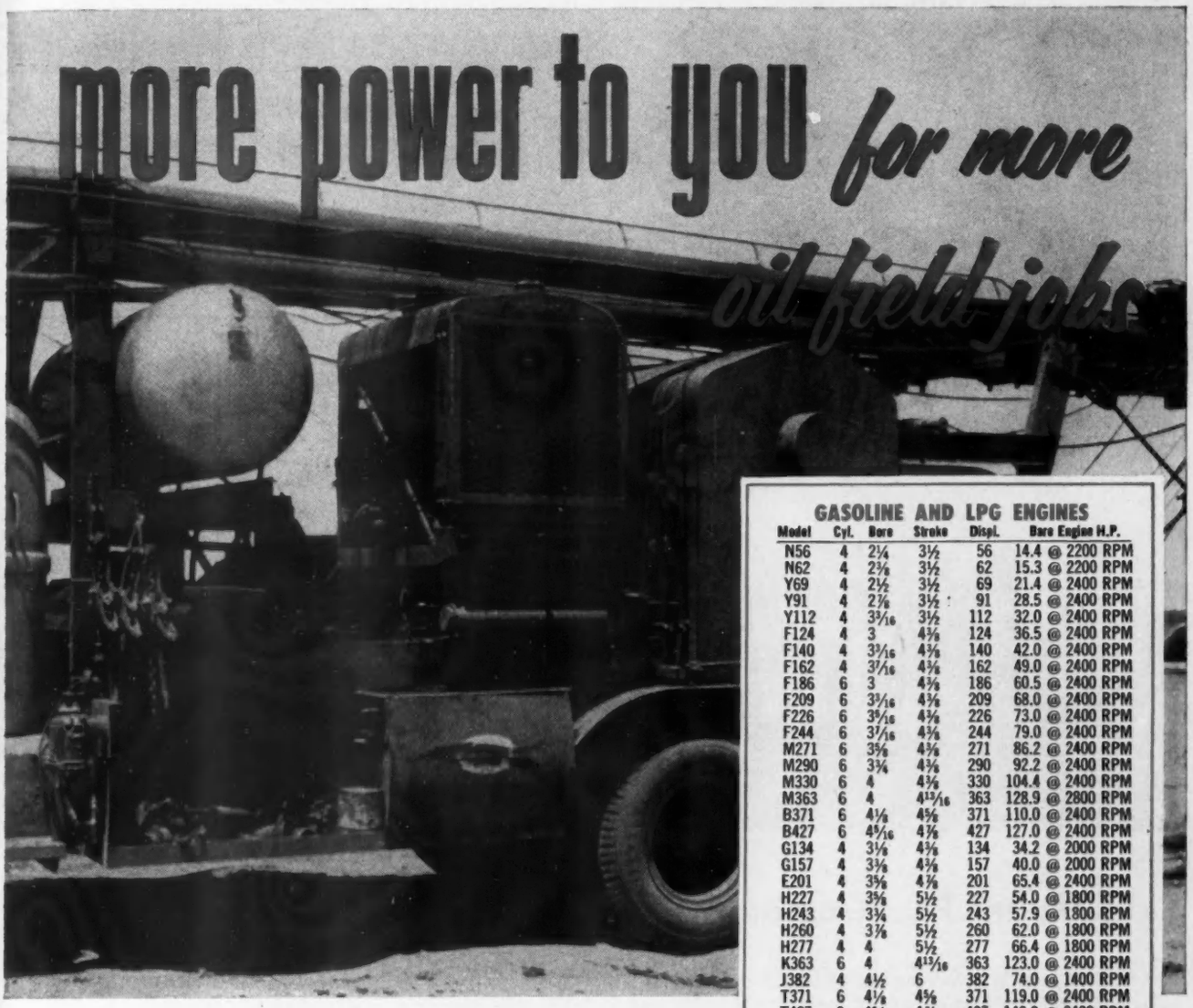
HERBERT J. WEEKS is geological counselor for foreign operations of Sun Oil Company. Formerly head of the geological staff at the company's Philadephia office, Weeks first joined Sun as a field geologist in the Southwest division. He went to the Philadelphia office in 1930 as geological advisor to the late J. Edgar Pew, then vice president in charge of production, and has been head of the Philadelphia geological staff since that time.

Also SAMUEL M. VAUCLAIN III is the new head of Sun's Philadelphia geological staff for U. S. and Canadian activities. Vauclain joined Sun Oil in 1939 as a scout in the company's Trans-Mississippi district. Prior to his assignment to the Philadelphia office in 1952 as staff geologist, he had been an assistant district geologist at Jackson, Miss.

•

ARTHUR V. DANNER, vice president and director of Mobil Overseas Oil Company, Inc., has been elected president to succeed PAUL V. KEYSER, JR. Keyser, a vice president and director of Socony Mobil Oil Company, Inc., will continue as a member of the Mobil Overseas board.

more power to you *for more oil field jobs*



All through the oil fields, you'll find abundant proof of the stamina that has made Continentals first choice for so many tough jobs. The Wichtex service unit pictured here, powered by Continental Red Seal closed power unit, is operated by the Wilcox Well Service Company of Rule, Texas. . . . . The petroleum industry's widening use of Red Seal engines and power units traces mainly to two factors. One is the broad diversification of the Red Seal line, with more than 100 basic models at closely-spaced power levels, and the other is Continental's long standing reputation for dependability—their inbuilt capacity to deliver more power, longer, at lower cost. . . . . Ask your oil field supply store or get in touch with the nearest Continental Office.

• • •

GASOLINE AND LPG ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
N56	4	2¼	3½	56	14.4 @ 2200 RPM
N62	4	2⅜	3½	62	15.3 @ 2200 RPM
Y69	4	2½	3½	69	21.4 @ 2400 RPM
Y91	4	2⅞	3½	91	28.5 @ 2400 RPM
Y112	4	3 3/16	3½	112	32.0 @ 2400 RPM
F124	4	3	4⅜	124	36.5 @ 2400 RPM
F140	4	3 3/16	4⅜	140	42.0 @ 2400 RPM
F162	4	3 7/16	4⅜	162	49.0 @ 2400 RPM
F186	6	3	4⅜	186	60.5 @ 2400 RPM
F209	6	3 3/16	4⅜	209	68.0 @ 2400 RPM
F226	6	3 5/16	4⅜	226	73.0 @ 2400 RPM
F244	6	3 7/16	4⅜	244	79.0 @ 2400 RPM
M271	6	3⅝	4⅜	271	86.2 @ 2400 RPM
M290	6	3¾	4⅜	290	92.2 @ 2400 RPM
M330	6	4	4⅜	330	104.4 @ 2400 RPM
M363	6	4	4 13/16	363	128.9 @ 2800 RPM
B371	6	4⅛	4½	371	110.0 @ 2400 RPM
B427	6	4 5/16	4⅞	427	127.0 @ 2400 RPM
G134	4	3⅛	4⅜	134	34.2 @ 2000 RPM
G157	4	3⅛	4⅜	157	40.0 @ 2000 RPM
E201	4	3⅝	4⅞	201	65.4 @ 2400 RPM
H227	4	3⅝	5½	227	54.0 @ 1800 RPM
H243	4	3¾	5½	243	57.9 @ 1800 RPM
H260	4	3⅞	5½	260	62.0 @ 1800 RPM
H277	4	4	5½	277	66.4 @ 1800 RPM
K363	6	4	4 13/16	363	123.0 @ 2400 RPM
J382	4	4½	6	382	74.0 @ 1400 RPM
T371	6	4½	4½	371	119.0 @ 2400 RPM
T427	6	4 5/16	4⅞	427	140.0 @ 2400 RPM
U501	6	4½	5¼	501	159.0 @ 2400 RPM
R513	6	4½	5⅜	513	164.3 @ 2400 RPM
R572	6	4¾	5⅜	572	182.4 @ 2400 RPM
R602	6	4⅞	5⅜	602	191.7 @ 2400 RPM
V603	8	4¾	4¼	603	220.0 @ 2800 RPM
S749	6	5⅛	5½	749	217.0 @ 2200 RPM
S820	6	5⅛	5½	820	237.0 @ 2200 RPM

CUSHIONED POWER DIESEL ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
ZD129	4	3¼	3⅞	129	34.0 @ 2000 RPM
GD157	4	3⅛	4⅛	157	39.0 @ 2000 RPM
*ED201	4	3⅝	4⅞	201	45.8 @ 2000 RPM
HD243	4	3¾	5½	243	55.0 @ 2000 RPM
*HD260	4	3⅞	5½	260	59.0 @ 2000 RPM
*HD277	4	4	5½	277	63.2 @ 2200 RPM
*JD382	4	4½	6	382	72.5 @ 1600 RPM
TD427	6	4 1/16	4⅛	427	106.0 @ 2000 RPM
RD572	6	4¾	5⅜	572	154.0 @ 2000 RPM
VD603	8	4¼	4¼	603	175.0 @ 2600 RPM
SD802	6	5 1/16	5½	802	202.0 @ 1800 RPM

*Available for industrial applications only.

SERVICE FACILITIES AND GENUINE RED SEAL PARTS AVAILABLE EVERYWHERE

CONTINENTAL MOTORS · Powerful as the Nation · AMERICA'S STANDARD

Continental Motors Corporation

MUSKEGON, MICHIGAN

6 EAST 45TH STREET, NEW YORK 17, NEW YORK • 6218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 3817 SOUTH SANTA FE AVENUE, LOS ANGELES 58, CALIFORNIA • 1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GEORGIA

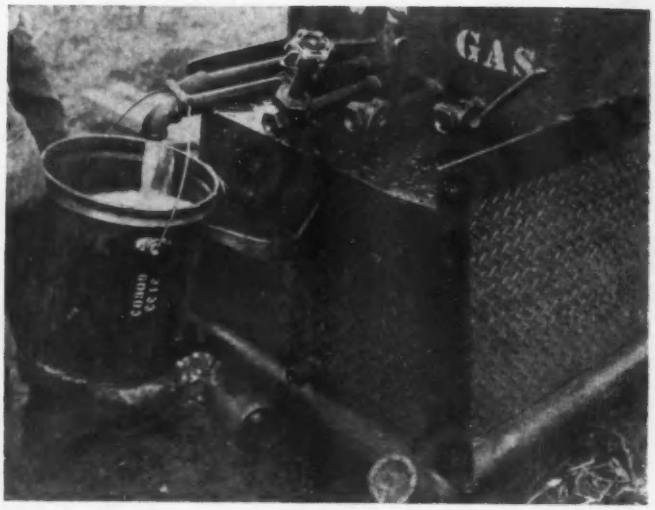
GOOD EQUIPMENT IS BETTER WITH CONTINENTAL RED SEAL POWER

We put the MOST into

DRILLING HINTS

These **How-To-Do-It** Ideas Can Save You Money

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.



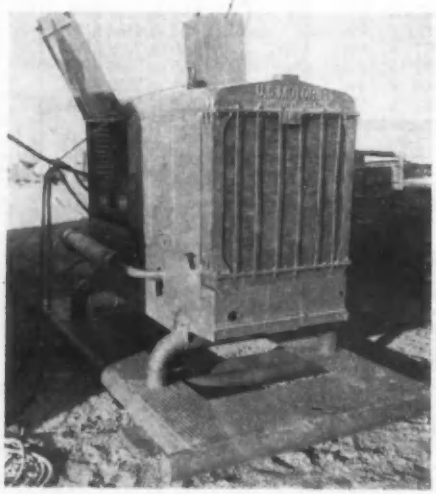
Skid Mount Five-Compartment Lubricant Unit for Storage

To store fuel and lubricants on a location, use the illustrated skid-mounted unit. It is a shopmade job with five separate compartments of various volume. The compartments or tanks are made of sheet steel with 6-inch nipples for filling and 1-inch pipe for vents. The outlets for the fluids are 1-inch pipe which run inside the tanks to the end of the unit.

At this point valves are installed to control the flow. An extension, such as the one in use, allows easy filling of small containers. Each of the tanks and outlets is plainly marked to avoid mistakes or confusion.

As an added feature on this unit a basket-like storage space is provided at one end for fittings or tools, and an enclosed space is included at the other.

This unit is handy and of strong enough construction to withstand the rigors of oil field use.



Help Engine Maintenance With Light Pipe Mounting

Neatness, accessibility and simplicity of construction are embodied in the unitized generator unit base fabricated by a drilling contractor in the Four Corners area. Mounted on a conventional portable base covered with non-skid diamond plate, the engine support consists of a pair of 3-inch pipe rails which employ 3-inch welded ells as the legs. The unitized mount not only affords greater accessibility to the under side of the engine and generator but, because of the elimination of the commonly-used boxed-in steel skirt and structural materials, less weight is involved.

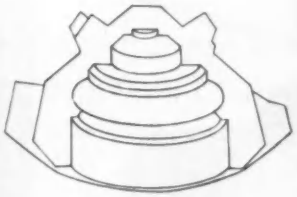
Leaving the deck or floor plate open directly beneath the engine and generator also reduces weight and minimizes a potential fire hazard and the need for continual cleaning up of lube and grease drippings since the latter now fall to the ground. Provision is made for quickly detaching the engine unit from the mounting. Small flanges, one at each corner, hold the unit in place with only two bolts at each point.

(Courtesy Humble Oil & Refining Company.)

We put the MOST into

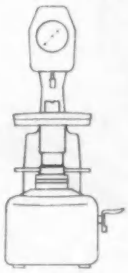
H C Smith ROCK BITS

to make them the BEST!



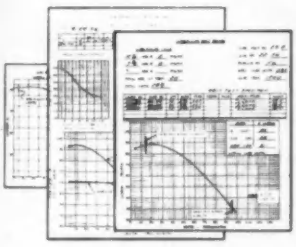
DESIGN

Thousands of hours of design engineering, based on field tests and reports, take in every detail of an H. C. Smith Bit. Tooth design—angle, thickness, shape, spacing—bearings and races, cone shape and structure, bit legs and their stress patterns . . . every part has been designed and tested for effective action on bottom and long service life.



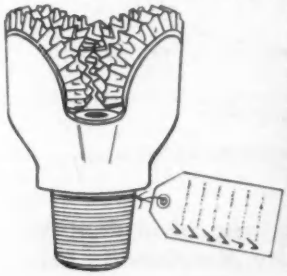
METALLURGY

The field is already familiar with the high standards of H. C. Smith metallurgy—the fact that all our steels are made to our own strict specifications; that every lot is tested by ourselves to be sure that it meets our requirements, and that our forging process is controlled to maintain maximum strength in all parts.



HEAT TREATMENT

The H. C. Smith system of heat treatment control is the most rigid and accurate in the industry. By putting standard samples of every heat of steel through our regular heat treating cycle before parts are made, the reactions of every lot are pre-determined—the hardness and carburization of every part of a Smith Bit is a known factor even before manufacture.



INSPECTION

The careful records kept on the heat treatment of every lot is only one step in the systematic inspection of all parts that go into an H. C. Smith Bit. The long service life of H. C. Smith bits in the field, reported by literally hundreds of good drillers, is the best testimony to the fact that our inspection system doesn't let a faulty bit part get out of the plant.

and the service your H. C. Smith man gives you is final proof that "You'll do better with H. C. Smith Bits!"

-every bit the best

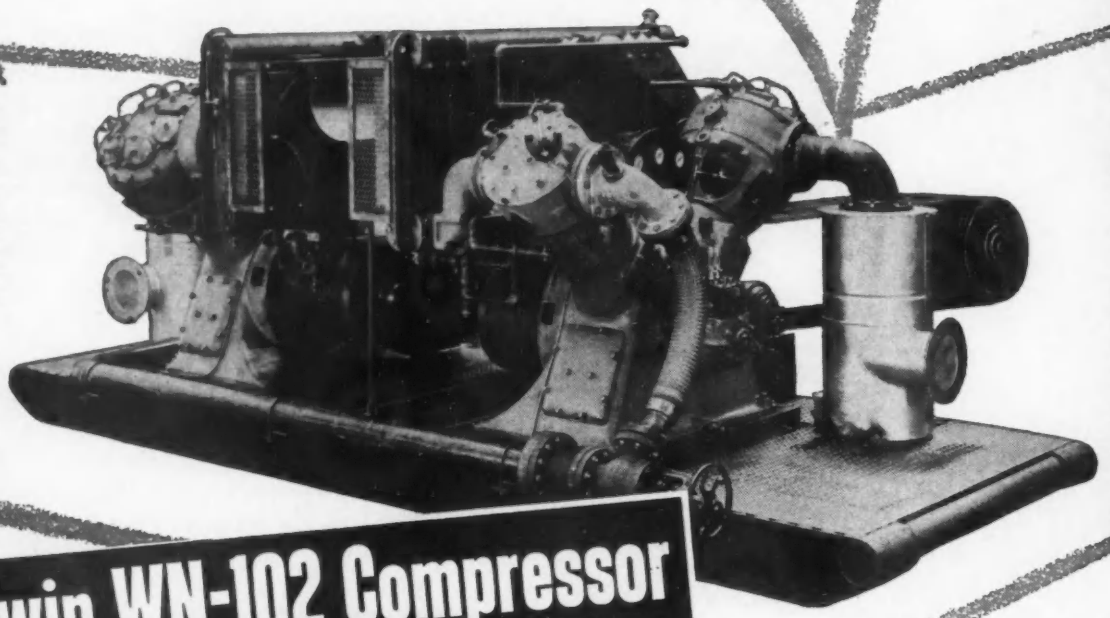
H C Smith OIL TOOL CO.

GENERAL OFFICES, EXPORT OFFICES AND PLANT: COMPTON, CALIF.

BRANCHES IN ALL PRINCIPAL OIL CENTERS IN THE UNITED STATES AND CANADA

For more data on advertised products, use Readers' Service Cards, last page.

Air Drilling Package =



JOY Twin WN-102 Compressor

Move it in . . . belt it to the drilling engine . . . and begin drilling. That's all it takes to be "in business" with the Joy Twin WN-102. Here's the rundown on *why* the Joy Twin WN-102 is the ideal compressor for your air and gas drilling operations:

- *It is portable . . . mounted on a heavy, oil-field-type skid.*
- *It supplies up to 1512 cubic feet of actual air per minute at pressures up to 200 psi . . .adequate for most drilling jobs.*
- *It is driven by V-belts from the auxiliary mud-pump sheave on the drilling engine . . . requires no additional power in most cases.*
- *It is compact enough to be within highway limits when moving between drilling sites.*
- *It's designed for the job . . . only Joy supplies a heavy-duty, water-cooled package type compressor for this application.*

The Twin WN-102 is but one of the many outstanding Joy compressors which are applicable to air and gas drilling. In the complete Joy line you are certain to find just the compressor to do your job.

For complete information, write, giving full details on requirements, to ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 48-30

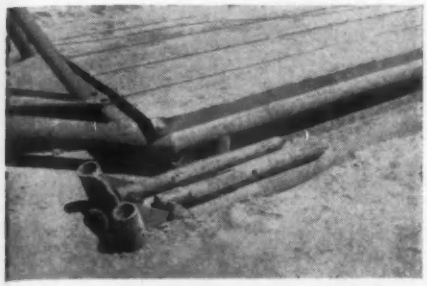
Consult a Joy Engineer

FOR AIR COMPRESSORS • MOTORIZED DRILL RIGS
GAS GATHERING COMPRESSORS
PORTABLE LIGHTING LINES

WSW 05944-48

JOY

SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885



Holders Prevent Loss Of Drill Pipe Chute Legs

A novel method of minimizing the chance of losing the two detachable legs belonging to the guide chute that is used when laying down drill pipe, is contained in the idea developed by one contractor.

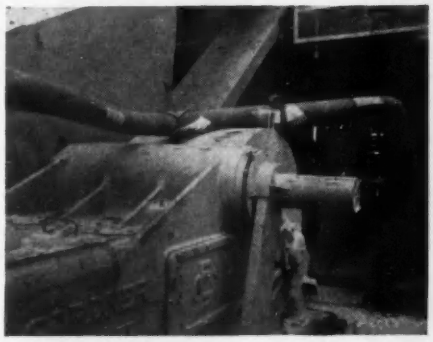
On the underside of the chute, shown in an upside down position on the ground in the accompanying photograph, two, 1-foot lengths of 2½-inch pipe were split and welded side by side. The internal diameter of these holders is such that the detachable legs of 2-inch pipe can slide easily through them, from end to end, yet are not loose enough to fall out during rig moves. The two legs which, in their operating position, are inserted in the sockets at the head, or rig end of the chute, are held in the holders with the same two bolts which pin them to the chute leg sockets.

It takes only a minute or two to pull the leg pins, insert the legs in the holders and run the bolts through the leg holes again. Welded to the underside of the chute, the holders are not in the way during laying-down operations and will repay their small investment many times over in providing positive assurance that the two legs will be on hand when needed.

(Courtesy Humble Oil & Refining Company.)

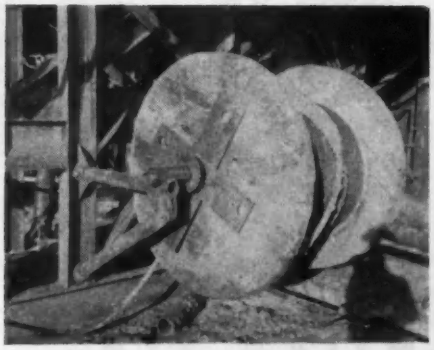
Old Pieces of Tire Casing Save Rotary Hose Wear

Since the custom has become rather common to hook the mud pump to the standpipe in the derrick with a section of rotary hose, the problem of abrasion where the hose touches other equipment becomes noticeable.



One method of correcting this situation can be found by applying short pieces of tire casing to the hose where the contact is made.

Tie the tire casing fast to the hose so that it is necessary for the steel to run against the casing instead of the rotary hose. This allows longer pieces of hose to be used and makes it easier to spot the mud pumps on location.



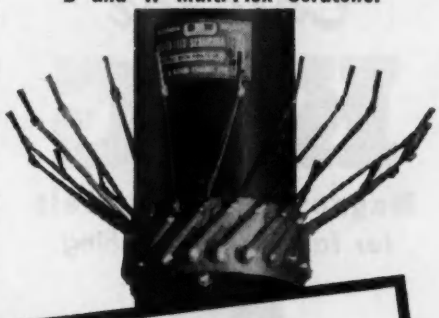
Turn Wire Line Spool With New Attachments

A feature that still further increases the efficiency of the compact wire line spool support that attaches to the

How-To-Do-It Ideas Earn Money, too!

$10—WORLD OIL editors want how-to-do-it ideas, so your favorite short cut or invention could put money in your pocket! Write down the substance of that latest idea and send it in with a picture or drawing of the installation . . . if accepted, $10 will be yours. Send those money-making ideas today to Hints Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.

B and W Multi-Flex Scratcher



B and W Inc.
For a good cement job

B and W
Latch-On Centralizer

Also: B and W Multi-Flex Scratcher • Hinged Nu-Coil Scratcher • Rotating Scratcher, Multi-Flex type • Rotating Scratcher, Nu-Coil type • Latch-On Centralizer with Kon-Kave Bow • Latch-On Stabilizer • Stabilock

B and W Inc.
Well Completion Specialists

GULF COAST
Box 5266
Houston 12, Texas
Phone WA 3-6603

WEST COAST
Box 3751, Terminal Annex
Los Angeles 54, California
Phone FAculty 1-2463

6903

For more data on advertised products, use Readers' Service Cards, last page.

side of the rig sub-structure is contained in the unit shown in the accompanying photograph.

To one end of the pipe axle attach a ¼-inch steel plate fashioned into the shape of a cross, each arm being approximately two feet in length, measured from the center point. Holes in each arm permit attaching it to one or more of the spool tie-bolts and small holes permit anchoring it with several spikes, if more desirable. Attach a small sprocket to the axle between this cross and the bearing or cradle in which the axle rests.

With such an arrangement, when the spool must be turned to pull wire line on or off, much man-power and rig time can be saved by driving it with some power take-off source. This is particularly useful when a full spool is installed and when the heavier, larger diameter wire lines are being used.

(Courtesy Humble Oil & Refining Company.)

Construct Tripod Stand For Filling-Up Casing

Construct a special unit for use in filling-up the casing. This unit is composed of a tripod stand constructed of angle iron which is attached to the mud line in such a manner as to hold the fill-up nozzle in an elevated position. A swivel joint in the mud line at the apex of the

Call for

K & G

Magnetic Fishing Tools

for fast, efficient fishing

4971

In sizes 1¾" through 11½"
Available through most fishing tool companies.

K & G

OIL TOOL AND SERVICE COMPANY, INC.

2703 Sackett Street • Houston 6, Texas
JAckson 2-5436

Branch Offices: CALIFORNIA: Avenal, Bakersfield, Long Beach, Los Angeles, Ventura • ILLINOIS: Olney • KANSAS: Great Bend, Liberal • LOUISIANA: Lake Charles, Jennings, New Iberia, Houma, Harvey • NEW MEXICO: Farmington, Hobbs • OKLAHOMA: Healdton, Oklahoma City • TEXAS: Abilene, Andrews, Bay City, Beaumont, Borger, Brownfield, Corpus Christi, Edinburg, Houston, Kilgore, Odessa, San Angelo, Sherman, Snyder, Victoria, Wichita Falls • WYOMING: Casper.

WARN LOCK-O-MATIC HUBS

APPROVED "Jeep" EQUIPMENT

Automatically "idle" the front drive in 2-wheel drive

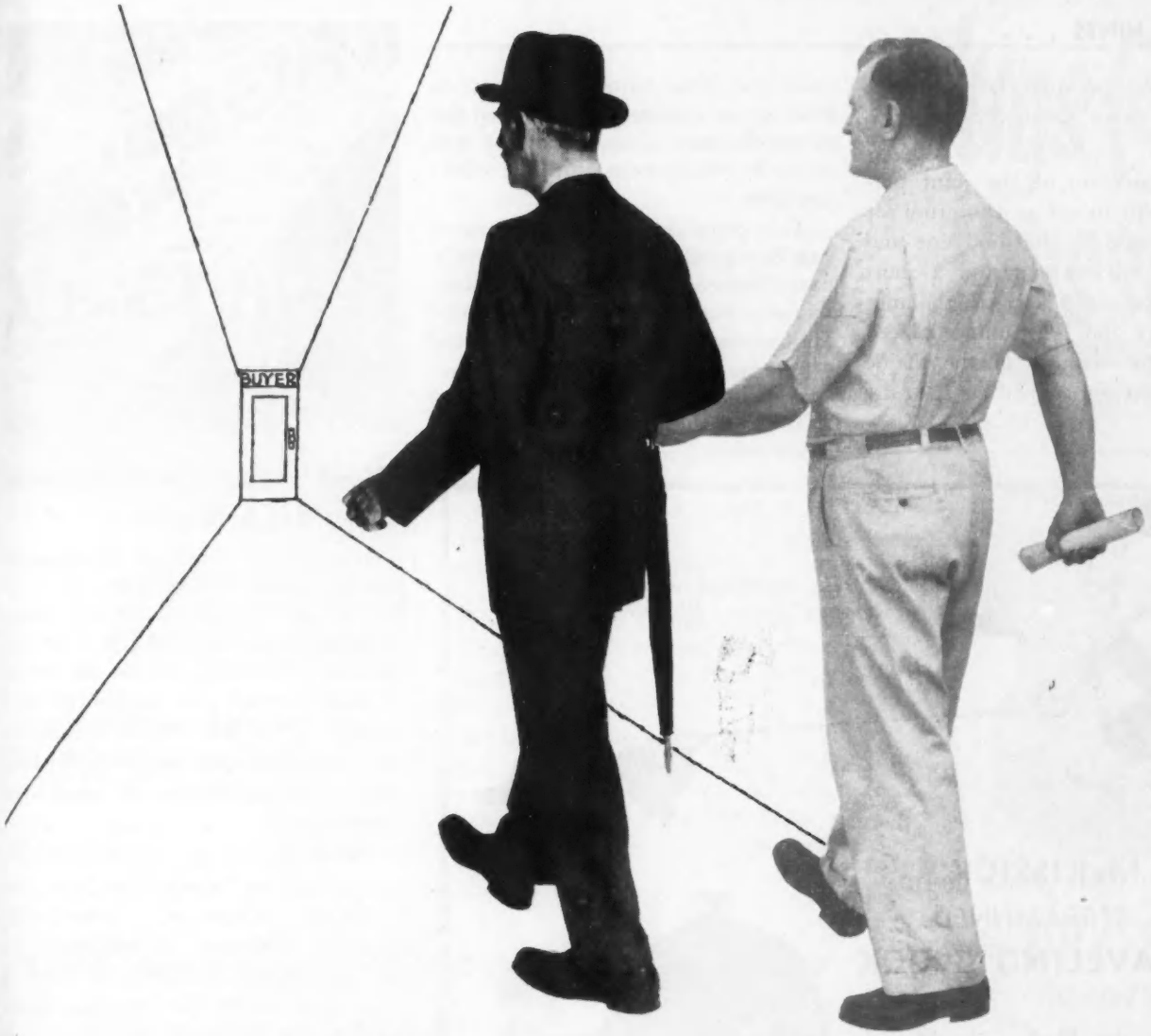
Patented

WARN SELECTIVE DRIVE HUBS

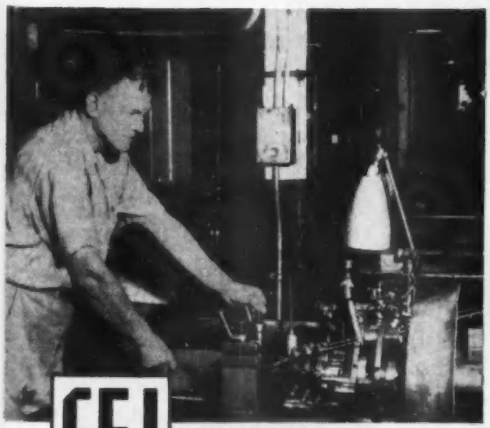
SAVE GEARS, TIRES, GAS!

Warn Hubs make your 4-wheel drive more useful than ever, because they make it into a "free-wheeling" 2-wheel drive, as well as a 4-wheel drive! Use it either way—automatically—*as you shift!* With Warn Lock-O-matics it *always* free-wheels in 2 w.d., always engages in 4 w.d., forward or reverse, *as you shift.* You automatically reduce front end wear, engine load, tire wear in 2 w.d.—there is no drag, gear whine, shimmy. Ask your 4-wheel drive dealer for a free demonstration of Warn Lock-O-matic or Locking (manual) Hubs today, or write. Models for all 4-wheel drives to 1½ tons.

WARN MFG. CO., Riverton Box 6064-WO3, Seattle 88, Wash.



Your Wickwire Rope Distributor and our closer operator ...ready to help you



This closer operator—running a machine which forms our rope—is with your Wickwire Rope Distributor every time he makes a call.

True, he's physically in the mill, where he's carefully conducting this final fabricating operation. But, whenever your Wickwire Distributor makes a call, he has the full assurance that every foot of Wickwire Rope has been carefully assembled by skilled craftsmen . . . and that it will give you long, trouble-free service on your job.

It's just one more reason why your Wickwire Distributor knows he's got top-quality wire rope, slings and strand to sell . . . and that these products will serve you well.

4085

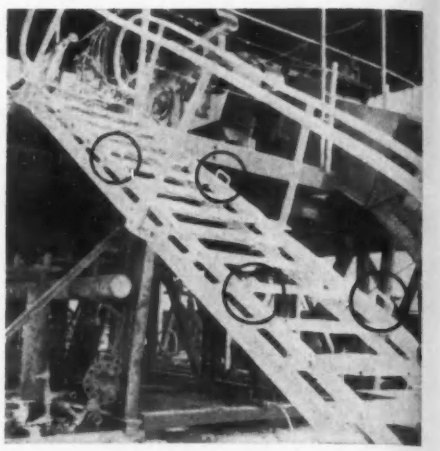
A PRODUCT OF THE COLORADO FUEL AND IRON CORPORATION

tripod stand permits the mud line nozzle to move vertically or horizontally.

A T-connection at the joint permits the joint to act as a fulcrum for a lever formed by the mud line and the nozzle on one end and a short length of pipe and a counterbalance on the other end. This unit is placed in service by setting it on the offside of the rotary and connecting it to the mud line. The fill-up line nozzle is held in an elevated position by the counterbalance when not in use and it can be swung away from the working area.

This proposed fill-up arrangement can be rigged up quickly and is very easy to use. It also promotes safety by reducing fatigue of the operator and provides better control of the fill-up line while it is under pressure.

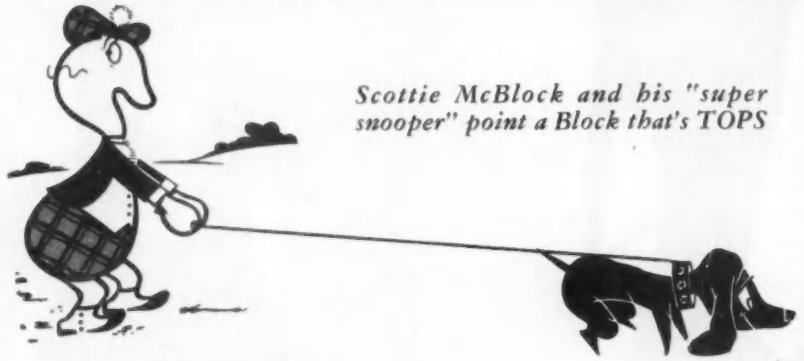
(Courtesy Humble Oil & Refining Company.)



Weld Shopmade Handholds Onto Rig Staircase

Handholds for manual handling of the staircase, or for tying on with a winch line or catline can help when moving a staircase into place around the rig. These handholds, made of ¾-inch sucker rod material and welded at the position of balance on the stair stringer, will enable four men to move this piece of equipment quite easily.

When rigging up or tearing down, the catline or winch line from the truck can be fastened to these handholds or bails and the staircase can be lowered to the ground. Here it can be moved by four crewmen quite readily. By providing these handholds or bails for use with catline or winch line, it assures that the lines are properly placed for moving and are not wrapped around a stairstep, or around the stair stringers where they could crimp or bend the staircase



Scottie McBlock and his "super snooper" point a Block that's TOPS

McKISSICK'S
STREAMLINED
TRAVELING BLOCK

Here's the block with the very widest range of sizes and capacities. For most efficient, trouble free handling of tubing, rods, etc.

Featuring E-Z opening guards, an exclusive McKissick feature, for quick, simple reeving, a few turns, bolts swing out. No parts removed — guards swing on extended arm to closed position and lock bolts tightened.

McKISSICK builds a
"Better Block for Every Purpose"

McKISSICK

McKISSICK PRODUCTS CORPORATION
Box 2496 Tulsa, Oklahoma

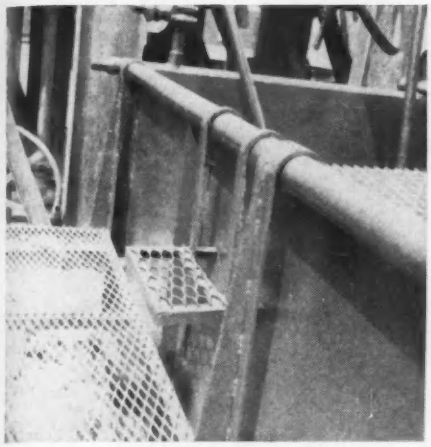
How to Order Your 1956 Index

A complete editorial index covering all issues of WORLD OIL published during 1956 has been compiled and bound separately in convenient pamphlet form. It will be sent free to all subscribers requesting copies.

To get your copy, address orders to the Librarian, Gulf Publishing Company, Post Office Box 2608, Houston 1, Texas. Or if you prefer, you can use the convenient Readers' Service Blue Postcard on the last page of this issue. Just check the square indicated. Fill in your name and address. Drop the postage-paid card in the mail and the index will be sent you.

Act now. The supply is limited.

and thus necessitate a repair job. If time is taken to correctly place these handles where they will help to properly balance the staircase when moving, it would make it a lot easier to handle this load.



Service Shale Shaker From Walkway Step

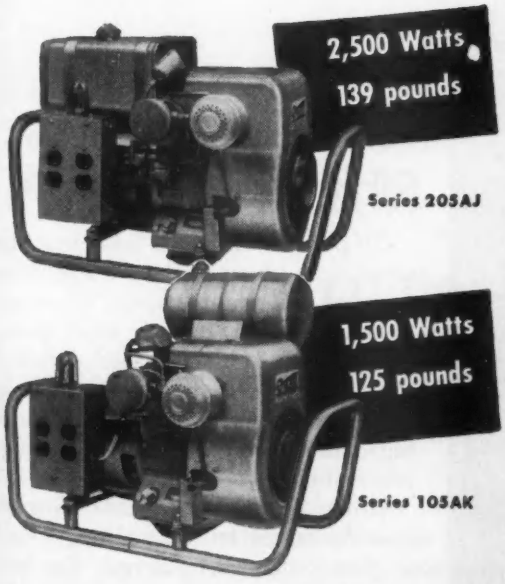
Where the shale shaker and the chemical mixing tanks are mounted on the steel mud tanks, it is necessary for crew members to work around and service these particular pieces of equipment. Usually this cannot be conveniently done from the walkway provided around the mud tanks.

Build an additional step at a convenient height above the walkway, to make access easy to the top of the tank and thence to the shaker and the chemical mixing tank. It will cut down on the accident rate where crew members would have to climb or vault to the top of the tank. Make the step approximately six to eight inches wide and one foot long of angle iron and expanded metal. Extend two metal straps up from the step to hook at the edge to fit over the 3-inch pipe that forms the top of the mud tank frame. Extend the ends of the step back and brace them against the side of the tank to provide greater stability.

Hang this step on the mud tank at any place it is desirable. It is easily removed when the tank is being transferred. It can also serve as a handy step at other parts of the tank.

YOU GET *4-cycle* DEPENDABILITY AND *Light weight* TOO . . . IN AN

ONAN Electric Plant



These power-packed electric plants give you all the *4-cycle* advantages of quick starting, long life and trouble-free operation . . . with an amazing weight saving over usual 4-cycle plants. You can carry them easily to any spot . . . and you can count on them delivering their full rated capacity as long as you need it. Both are single-cylinder, air-cooled . . . completely equipped and ready to go.

Other models to 75,000 watts.

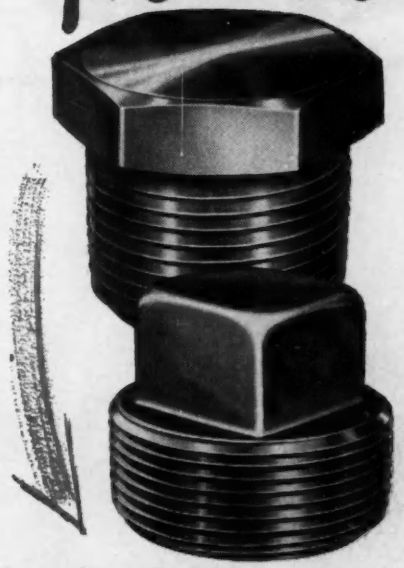
Write for special folder on lightweight models!

D. W. ONAN & SONS INC.

4181 University Ave. S. E., Minneapolis 14, Minnesota

Onan ELECTRIC PLANTS

plugs for Pressure



forged steel, high pressure plugs with **DRY SEAL** tapered threads

CAPITOL square head and hex head solid plugs have dry seal tapered threads to assure safe, permanent high pressure installations. Conveniently packaged for easier handling.

Square Head Solid Plugs sizes 1" thru 2", all forged steel. Hex Head Plugs sizes ½" thru 2" machined from solid bar.

You'll like these thread protectors, too!

CAP **CAPITOL**

MFG. & SUPPLY CO.

COLUMBUS, OHIO

COUPLINGS — NIPPLES — UNIONS — BUSHINGS — PLUGS — REDUCERS — CAPS—CAPADAPTERS—WELL SUPPLIES

PRODUCTION HINTS

These How-To-Do-It Ideas Can Save You Money

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.

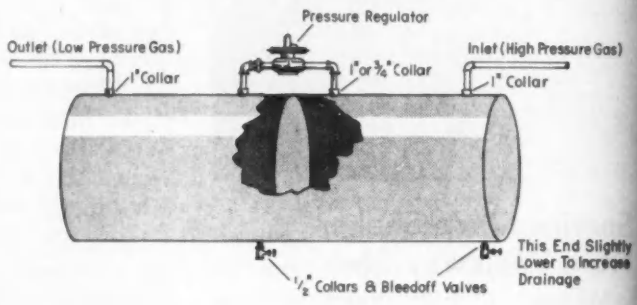
Spot Stuffing Box Leaks With Telescope Checks

One pumper who has 38 wells under his supervision uses the telescope to spot stuffing box leaks and any unusual operation of the wells. He can see nearly all the wells from the top of the tank batteries, and it is a simple matter to pick up the telescope and check each of the wells.

This device does not release the pumper from making his necessary rounds but keeps him informed as to the condition of the wells between rounds. If any of the units is running faster than usual, he can immediately make a trip to the well to see if the rods are parted. If a well goes off production and the polish rod becomes hot, he can spot the dark color on the rod caused by the burned rubber. He can then make an extra trip and make the necessary adjustments.

This idea keeps the pumper in close contact with the wells under his supervision.

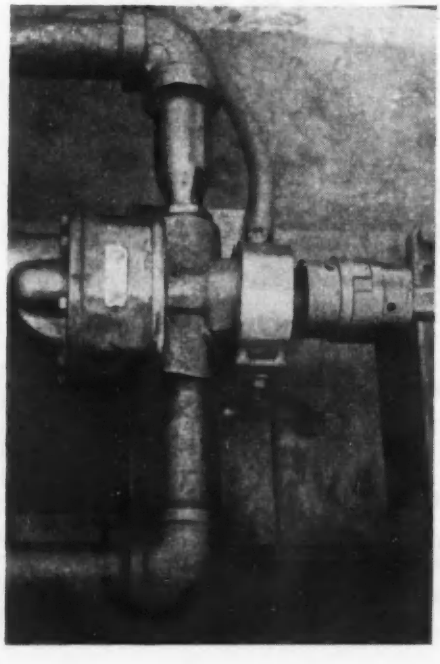
Gas Log Reduces Regulator Freeze-Up



The accompanying sketch is of a shopmade gas log. This unit is used to remove some of the liquids from wet gas being used on a lease to run engines or supply heater fire boxes. The log contains two compartments with a pressure regulator between them.

Its ability to remove a reasonable amount of liquid from the gas before it enters the pressure regulator reduces the possibility of regulator freeze-up. Having a second compartment after the regulator allows more liquid to be drawn off. This results in a much drier, and therefore more satisfactory gas for lease use.

The length of casing is used to make up the body of the unit and the necessary valves and fittings are installed as shown. This is a simple means of making a high pressure and low pressure gas log.

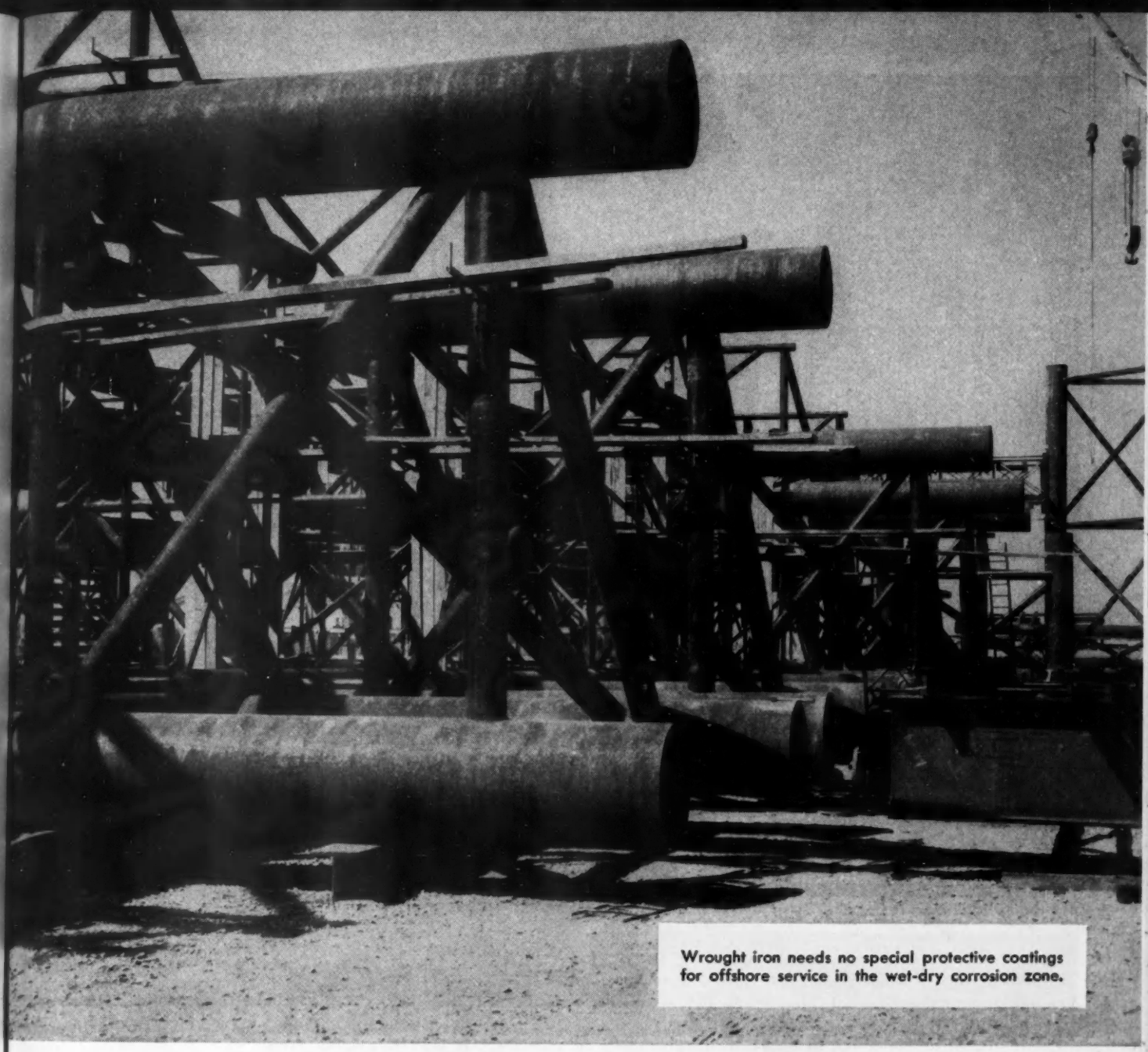


Install Housing to Prevent Oil Spraying Pump Engine

To prevent oil which leaks past the circulating pump packing gland from spraying the pump engine, construct a housing of 1/16-inch steel plate. Design it so as to completely enclose the circulating pump packing gland. Install the housing around the packing gland by bolting it to the pump frame using two brackets.

Hinge the top of the housing to provide access to the packing gland so that it can be tightened. Connect a drain hose to the bottom of the housing to provide an outlet for oil which has leaked past the packing gland. Previously, a housing was not used.

Use of this housing promotes



Wrought iron needs no special protective coatings for offshore service in the wet-dry corrosion zone.

Wrought Iron jackets for boat dock supports offer rugged resistance to corrosion

Corrosion fighters have found a time-tested defense in their war against salt water attack.

Rugged wrought iron, supported by service records dating back 100 years in punishing salt water applications, has won wide acceptance for duty in the critical splash areas. Wrought iron's *built-in* protection makes it ideal for use where wet-dry corrosion threatens service life.

Wrought iron's protective qualities are also ideal for combating corrosion of structural piping, platform decks, hand railings, ladders and steps, dolphins, grating, conduit, casing and tubing, and oil lines to tank farms.

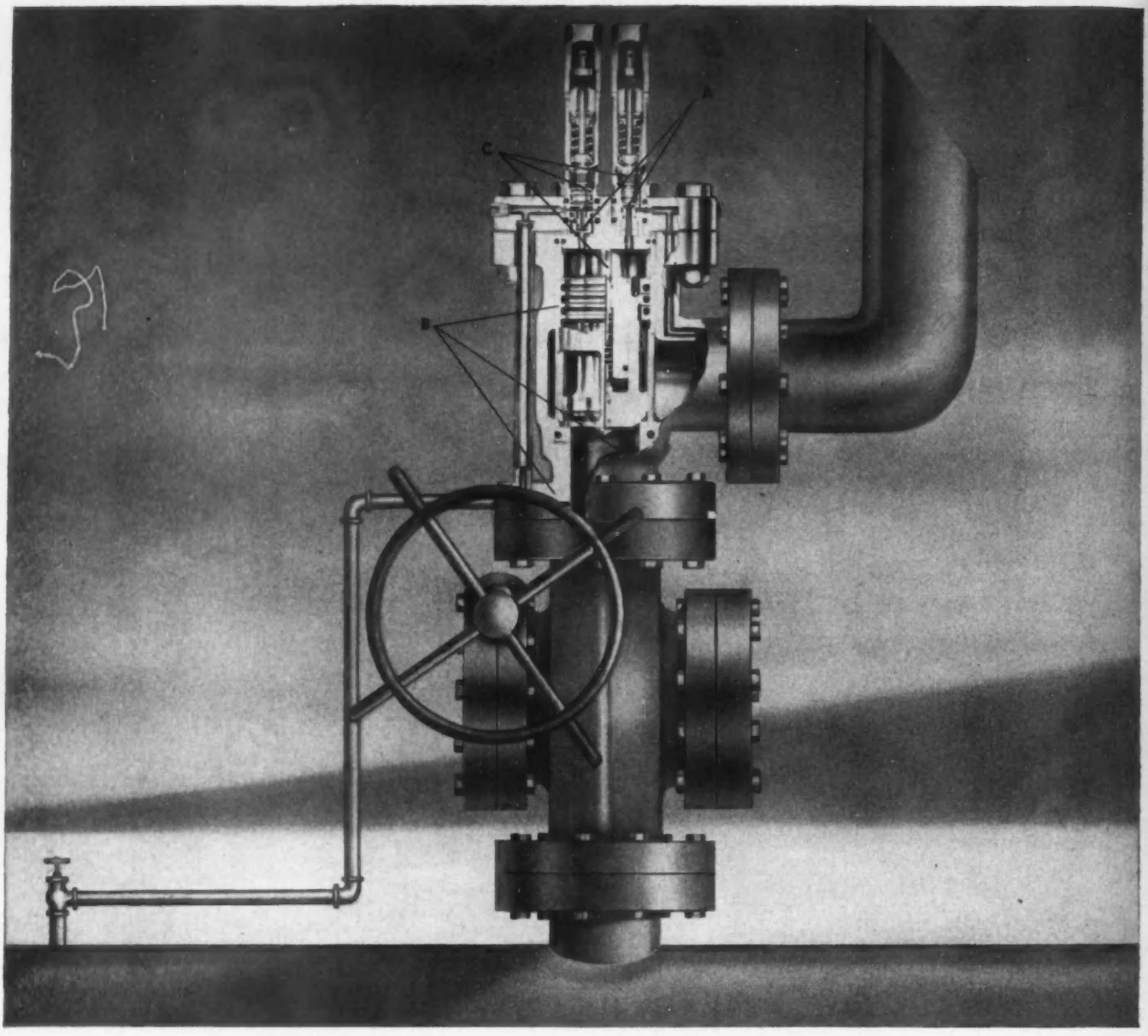
A talk with one of our field service engineers will show you how this material can help cut your corrosion control costs. Write us about your specific problem.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Division Offices in Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N.Y.

Available in Canada and throughout the world

BYERS *Wrought Iron Tubular and Hot Rolled Products*

ALSO ELECTRIC FURNACE QUALITY STEEL PRODUCTS



This "Type D" valve responds to changes as low as 1% of system pressure over unlimited cycles. For information write Garrett Oil Tools, Inc., P.O. Box 2427, Longview, Texas.

How Monel improves Garrett pressure relief valves

A. Critical control surfaces: Monel alloy helps preserve their dimensional accuracy despite corrosive and erosive attack.

B. Pressure structure: Monel alloy provides high basic strength, prevents untimely weakening from metal loss due to corrosion.

C. Working parts: Monel alloy withstands wear, impact, and other mechanical forms of trouble.

With Monel* nickel-copper alloy, Garrett high-pressure relief valves operate reliably even in remote locations where frequent maintenance is impractical. Monel withstands fast-moving and "sour" gases in the stream.

Monel and other Inco Nickel alloys are used in thousands of locations and many different types of drilling, producing and refining equipment. *They have proven uniquely resistant to corrosion, and well able to meet a wide range of severe physical requirements.* For assistance in their application, contact Inco's Development and Research Division.

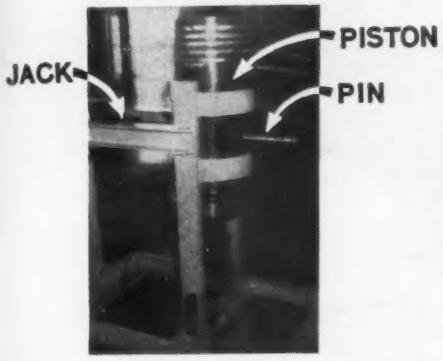
THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO TRADE MARK **NICKEL ALLOYS**

*Registered trademark

safety by eliminating the fire hazard caused when the packing gland would leak and spray the pump engine while the pump is unattended. The leakage is now contained within the housing and is drained to a sump barrel.

(Courtesy Humble Oil & Refining Company.)



Remove Power Piston Pins With Portable Frame, Jack

For an improved means of removing pins from the power pistons of compressors, mount a shopmade portable frame on rubber wheels. Use this in conjunction with a 20-ton hydraulic jack to remove the pins from the pistons. Employ a chain-hoist to lift the piston so that it can be secured with clamps on the frame.

Provide a bracket on the frame for supporting the hydraulic jack in the same plane with the piston pin. Remove the piston pin by exerting pressure with the hydraulic jack on a 1½-inch round extension bar which is positioned against the pin. Provide a rubber tip on the extension bar to prevent damage to the piston or the bushing usually, a sledge hammer

How-To-Do-It Ideas

Earn Money, too!

$10—WORLD OIL editors want how-to-do-it ideas, so your favorite short cut or invention could put money in your pocket! Write down the substance of that latest idea and send it in with a picture or drawing of the installation . . . if accepted, $10 will be yours. Send those money-making ideas today to Hints Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.

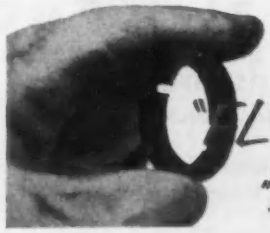
Perfect-Sealing—Step-cut design allows Flexite Rings to expand to a positive seal on the upstroke and fall freely on the downstroke.

Corrosion-Proof—Flexite Rings are machined from a special hard plastic composition which won't swell, corrode, nor disintegrate in sour oil.

Non-Swelling—Flexite Rings are precision ground for an exact fit in the barrel tube. No swelling nor soaking to size before running in.

Easy to Make Up—Flexite Ring plungers are easy to make up in the field. No special tools, fixtures nor instructions are necessary.

Wide-Design Rings—For deep-well pumping to afford greater sealing surface. Wide rings will fit standard A. P. I. rod or tubing pumps.



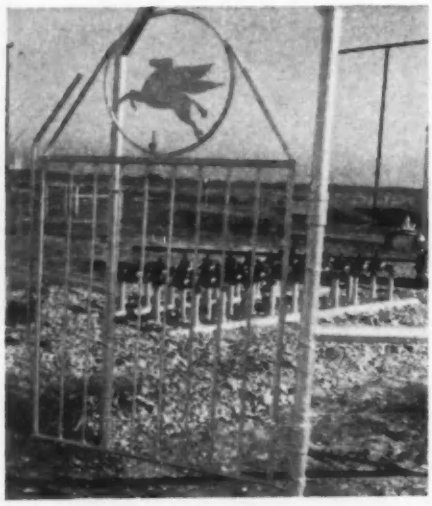
Harbison-Fischer
"FLEXITE" PLUNGERS
"Best Pumps in the Oil Patch"

For more data on advertised products, use Readers' Service Cards, last page.

and bar were used to remove the piston pin.

Use of this idea promotes safety and saves time in removing pins from the pistons. It also reduces damage to the pistons and pins.

(Courtesy Humble Oil & Refining Company.)



Make Versatile Gate Latch For Wood or Metal Frame

The simple, yet effective gate latch used on the illustrated gate should find numerous applications. It can be used on metal or wood gates of any size and is easy to make.

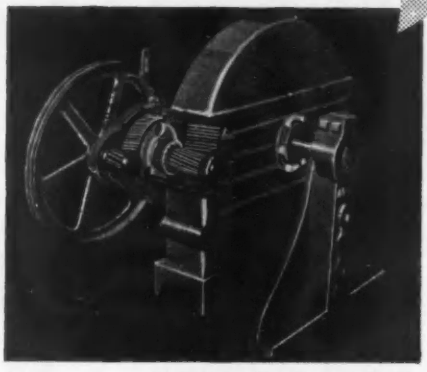
In this case form a 5½ foot piece of reinforcing rod to fit along the open side of the gate. Run it about three inches from the gate, as shown, with the bottom end welded in place (bolted on wooden gates).

The extreme length of the rod in relation to its diameter allows it to act as a spring and be bent toward the gate. When the pressure is released, it springs back to its original position. In this manner it is moved in and out of a small bracket on the frame around the gate.

QUICK to install!

EASY to counterbalance!

LOW-COST trouble-free service



. . . that's a JENSEN!

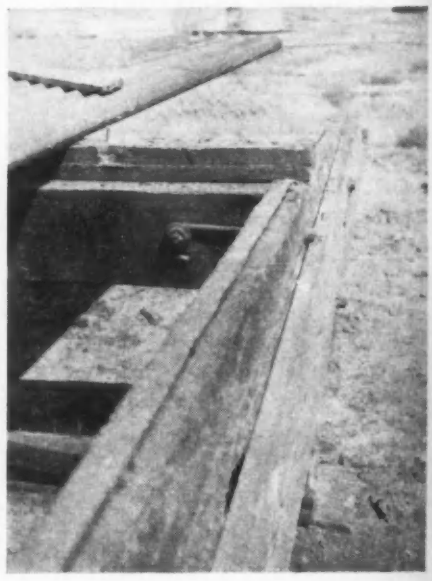
A JENSEN JACK has many outstanding features that meet the producer's requirements for economy and efficiency. Quick installation. Easy one-man counterbalancing. All-around low cost.

Changing gear ratios, from double to single and from single to double, is a quick one-man operation. Yes, sir, from beam to base, a JENSEN JACK has engineering features that afford dependable service and low-cost operation. Just ask anyone who has a JENSEN JACK over his well . . . or see your JENSEN Dealer. Write us, if you wish.

JENSEN JACKS

JENSEN BROS. MFG. CO., INC.
Coffeyville, Kansas, U.S.A.

Export Office:
60 East 42nd Street, New York, N. Y.



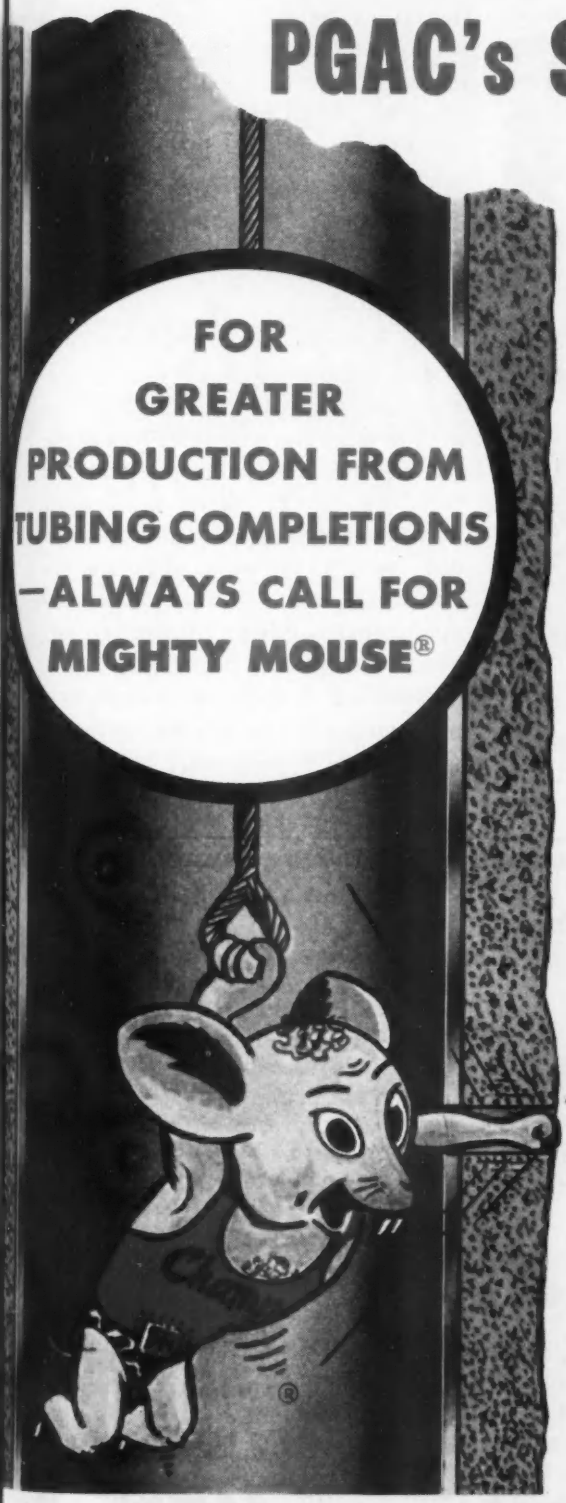
Repair Wooden Pipe Racks With Shopmade J-Bolts

Repairing production pipe racks, which, over the years, have weathered with resultant loosening of nails and bolts and general deterioration, can be facilitated with minimum cost and time by the method employed by one company. Instead of relying on corner brackets, trying to repair by driving larger and longer spikes which, in turn, often cause additional splitting, make use of shop-fabricated J-bolts approximately 15 inches long and installed as shown in the illustration.

Into the side of the adjacent 12x12 cross members bore holes through which long rig bolts are run, large diameter washers being placed on either end. Then, loop the J-bolts, run through holes bored in the plank stringers and likewise equipped with large washers, over the anchor bolts and tighten up the latter. Tightening the nuts on the J-bolts pulls the rack sections together snugly; strengthens

Here's Your Best Bet—Always—
For Better PERMANENT COMPLETIONS...

PGAC's Super MIGHTY MOUSE®



. . . the most powerful fixed-diameter, tubing-type, expendable jet gun now available anywhere!

The 1¾" O.D. Super **Mighty Mouse** shoots either 5 or 6 jets per foot—the 2⅛" size shoots 4 jets per foot. All Jets fired horizontally into the formation, thereby utilizing **all** of their superior power for deeper, larger, debris-free perforations—all around the casing. Any length of formation can be shot, limited only by length of gun assembly that can be picked up and lowered into the well-head.

Here Are Some of the Reasons for the Phenominal Success of *Super* "Mighty Mouse" Jet Guns

- No carrot left to plug perforation after firing.
- No gun debris remains in perforated zone after firing to obstruct subsequent operations.
- Shoots deeper, larger and cleaner holes than any other fixed-diameter expendable gun.
- Semi-Flexible gun construction permits passage through kinked or bent tubing.
- Larger fluid bypass area speeds running gun in well—allows passage through pump-seat nipples and tubing constrictions.
- No over-all gun enclosure to leak fluid and cause misfiring—each charge separately contained.
- Unique safety features—firing initiated from bottom to determine completed operation.
- Penetration from the 1¾" gun almost equals that from 4" Jet guns . . . and from the 2⅛" gun penetration exceeds that of 4" Jet guns.
- Optional use of 5 or 6 shots per foot with the 1¾" gun reduces tubing completion cost.

MIGHTY MOUSE® IS STILL "CHAMP OF ALL THE MIDGET GUNS!"

PGAC-571

PERFORATING GUNS ATLAS CORPORATION

Houston, Texas Telephone REpublic 4-1651
General Offices and Main Plant: 7730 Scott Street — Sales Office Melrose Building

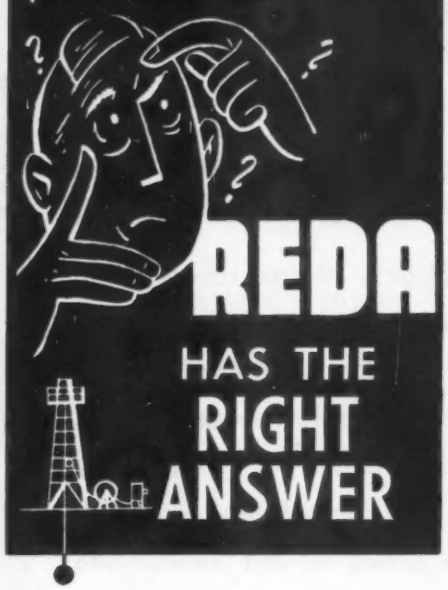
P G A C OIL FIELD SERVICES

CALL FOR PROMPT SERVICE — ALWAYS READY TO SERVE YOU

TEXAS: Abilene — Alice — Beaumont — Bowie — Colorado City — Corpus Christi — Dallas — Fort Worth — Gainesville Graham — Houston — Longview — Midland — Odessa — Pampa — Victoria — Wichita Falls.
OKLAHOMA: Ardmore — Healdton — Oklahoma City — Pauls Valley — Pawhuska — Perry — Tulsa.
LOUISIANA: Houma — Lafayette — Lake Charles. **KANSAS:** Great Bend — Harper — Liberal. **NEW MEXICO:** Hobbs.

AFFILIATE COMPANIES: CANADA — Perforating Guns of Canada Ltd. Edmonton, Alberta
GERMANY — Atlas Deutsch- Amerikanische Olfelddienst G. m. b. H., Kiel VENEZUELA — Servicios Tecnicos Atlas, C.A. Caracas

HOW to increase production? Lower Cost?



REDA HAS THE RIGHT ANSWER

. . . from ⅓ HP to 300 HP . . . from 20 bbls to 25,000 bbls . . . from 200' to 10,000' and more . . . Yes, a REDA will do that pumping job BETTER . . .

Reda Pumps are used as original equipment, or replacement equipment, because they produce at a lower cost per barrel of fluid. Whether it's large volumes from shallow depths, or modest volumes from great depths, Reda Pumps provide operating savings.

IMPROVED DESIGN:

Constant research and design improvement are responsible for lengthened operating life, corrosion resistance, low labor cost per barrel of fluid produced.

IMPROVED EFFICIENCY:

Greatly improved overall efficiencies have improved Reda performance as much as 25%; a substantial operating saving.

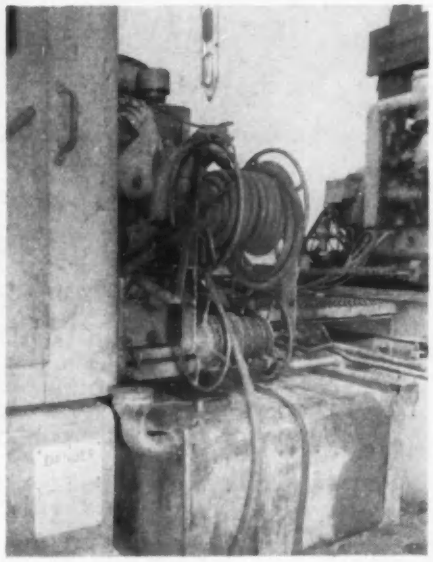
If you have a pumping problem, our engineering staff is always ready to assist you. Phone or write:

THE SIGN OF QUALITY

SUBMERGIBLE REDA PUMPS

REDA
PUMP COMPANY
BARTLESVILLE, OKLAHOMA

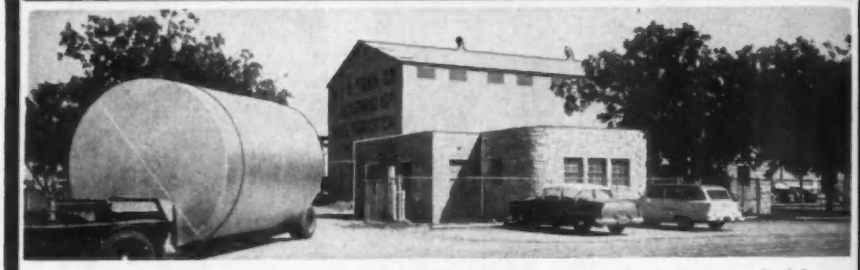
the entire rack. Such a method permits periodic tightening to check warping or shrinkage; will postpone for many years the ultimate abandonment of this type of wooden rack.



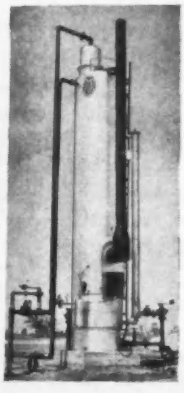
Hose Reels Permit Rapid Hook-up to Fuel, Water

Substantial savings in crew and rig time can be made through the use of unitized fuel and water line hose reels that can be mounted on the pulling unit truck. When the unit drives up to the well, it requires only several minutes for a man to pull off the necessary length of hose and connect into the dry gas fuel system and water line outlets at the well site. Within only a few minutes after that, the engines can be started and be warming up while other crew members start to rig blocks and lines.

On the unit shown in the photograph, space immediately behind the truck cab, at one end of the air compressor unit, was selected for mounting the two reels, one for gas; the other for water. Made of salvaged materials and assembled by the company welder, the units, although operated separately, are mounted on the same bracket. Other savings accrue, also, through use of such a reel. Weathering of the hoses is kept to a minimum and, by having them removed from the tool truck chances of injury, or outright loss, is minimized.



Our complete and modern facilities assure sound design, reliable manufacturing, and prompt, efficient service to every customer.



M & V Type P-V PRESSURE TREATERS

Outstandingly efficient and trouble-free—designed for pressure operation as oil and gas separator, treating unit, and settling tank. Stocked for immediate delivery in sizes 4′ x 21′, 5′ x 21′, 6′ x 21′, 8′ x 21′.

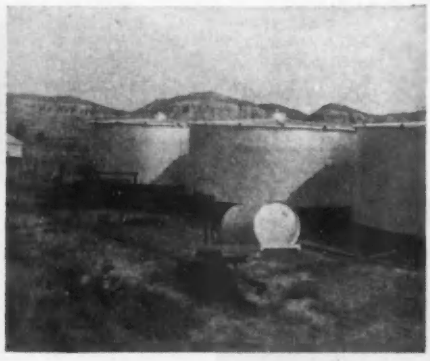
TANKS - TREATERS - SEPARATORS
Steel Fabrication
for the Oil Industry

MFD BY M&V TANK COMPANY — WICHITA FALLS, TEXAS

Make Chain Containers From 2 Thread Protectors

To provide a container for small chain or fittings, weld two casing thread protectors together with a steel plate at one end. Place a bail on the other end and the container is complete.

Such a unit can be used on a truck or around a rig to keep the chains from being lost. It also tends to keep them clean by providing a special place for them after use. By drilling holes in the bottom plate, the chains can be washed and oiled in their container and the excess water or oil allowed to drain off.



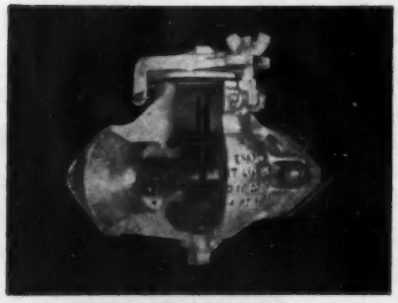
Water-filled Drum Permits Close Weight Box Control

Concrete blocks and/or scrap iron frequently are used in weight boxes in a central power pumping system, but there are occasions when, for reasons of convenience or flexibility of operation, a water-filled container may be desirable. Unless the concrete is in small blocks, with the weight being roughly 2.4 times that of water, it is not handled as easily as might be desired, and water-filled containers, in cases where moderate weights are needed, easily can be bled off, or added to in order to obtain a desired fine balance.

Such a water weight box is used by one company in counterbalancing a rod-line pump connected to a tank battery. A rectangular framework made of scrap channel iron and pipe, bolted to the jack, provides a cradle in which a large drum can be placed.

Using fresh water and keeping the exterior painted to prevent rusting, such a weight will last for years, and even when rust-through does occur, replacement of the drum is relatively easy and inexpensive. Major counterbalancing effects can be obtained by extending the cradle back a few feet or, by enlarging the bed concrete or scrap iron may be added, with the water drum providing the desired "trim" in reaching the necessary weight.

Enardo 1900 Series In-Line Vent Valve



Enardo 800 Series In-Line Vent Valve

Contact the representative nearest you for further information.

Jack Merrill Henderson, Texas	Harry Higginbotham Tulsa, Oklahoma
W. R. Lee Midland, Texas	K. S. Drane Houston, Texas
Jack D. Neff Ellinwood, Kansas	Bruce Heller Tulsa, Oklahoma

Are you still looking in the sky for profit losses? Enardo Vent Valves provide a means of keeping a predetermined pressure on stock tanks. These vent valves are used in conjunction with Enardo pressure type hatches. Set 2 to 4 ounces less than hatch pressure to prevent hatch venting.

On leases not using a positive venting system, that have changed to an Enardo Vapor Control System, it has been proven that there was an immediate increase in saleable fluid gravity. For, on a lease with a production of 50 barrels per day, it is possible to add a total savings of $1,482.00 in the books after the installation of proper hatches and vent valves, cutting gravity and volume loss.

Enardo 800 series Vent Valves are offerred in standard 2", 3" and 4" pipe sizes, pressure settings ½ to 16 ounces. Featuring aluminum or semi-steel bodies with plastic trim. Slip-On or flanged ends. Standard valve is 1 ounce pressure, 4/10 ounce vacuum.

Enardo 1900 series Vent Valves also offered in 2", 3" and 4" sizes, with or without companion flanges bolted on. Standard valve 2 ounce pressure, 4/10 ounce vacuum. Pressure settings from 2 to 24 ounces.

ENARDO manufacturing company

BOX 1647 TULSA, OKLA

For more data on advertised products, use Readers' Service Cards, last page.

HUNDREDS OF JOBS IN TWO YEARS PROVE . . .

CEALME

DOWELL

MOST EFFECTIVE CEMENTING SERVICE IN THE OIL INDUSTRY . . . USES LATEX-CEMENT SLURRY

Dowell Developed Cealment

Cealment*—the first really new cementing service in 20 years—was developed and introduced by Dowell in 1955 to answer cementing problems plaguing oil operators everywhere.

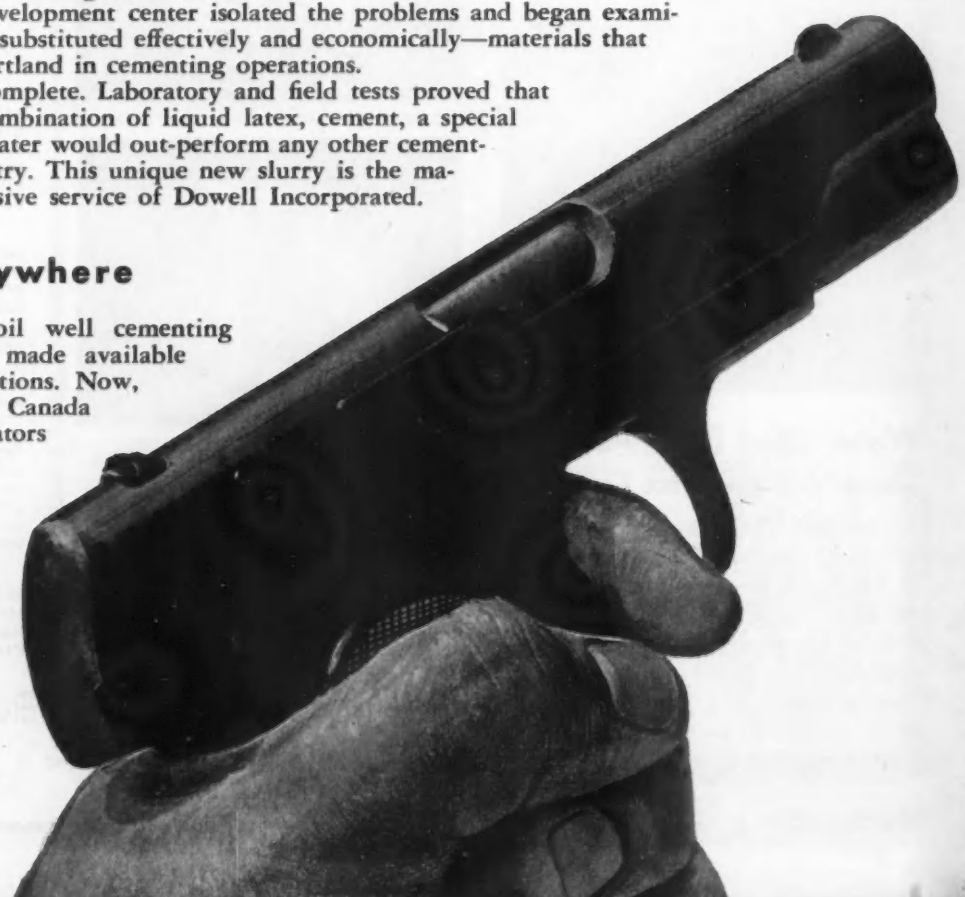
For years it had become increasingly apparent that common Portland cement could not always be depended upon to provide a satisfactory cement job. Regular cement was showing high fluid loss and a high shrinkage factor. As perforating became more practical, common Portland cementing became more impractical, shattering and breaking down under stress.

The Dowell research and development center isolated the problems and began examination of materials that could be substituted effectively and economically—materials that would give service superior to Portland in cementing operations.

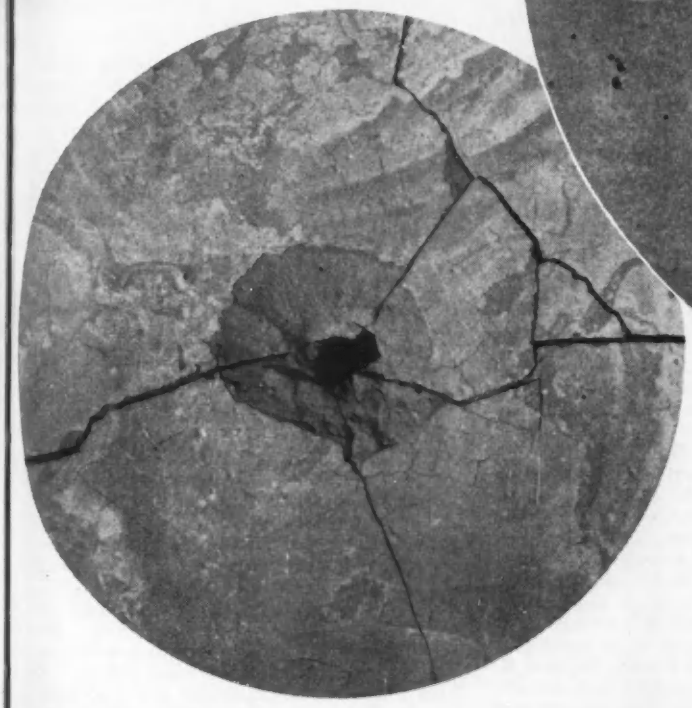
By early 1955 the job was complete. Laboratory and field tests proved that a slurry containing the proper combination of liquid latex, cement, a special Dowell surface-active agent and water would out-perform any other cementing material offered the oil industry. This unique new slurry is the material used in Cealment, an exclusive service of Dowell Incorporated.

Available Everywhere

Cealment, Dowell's specialized oil well cementing service using latex-cement, was made available in 1955 to all areas of oil operations. Now, throughout the United States, Canada and Venezuela—wherever oil operators want it Dowell provides Cealment service. Trained crews with hundreds of jobs and a proved product behind them are available from any of the nearby 165 Dowell offices and stations. Call Dowell and ask for Cealment on your next cement job.



ENT



These samples were shot with a 38-caliber automatic. The latex-cement disk above was pierced without shattering. The disk at left is common Portland cement after receiving the same treatment.

DEPENDABLE FOR TOUGH JOBS

Cealment has provided successful results in cementing jobs —even under the most difficult conditions. It can be used any place regular Portland is now being used. It has proved especially useful for setting liners, squeezing, setting long string, tailing-in on long string and repairing holes in casing. With Cealment you save money, because this Dowell service helps you avoid unnecessary squeeze jobs and costly return trips.

LOW SHRINKAGE—Latex-cement does not shrink when set under pressure.

SUPERIOR BONDING—Bonding strength between the formation and the casing—whether in oil or water—is superior with Cealment.

GREATER RESILIENCY—Resists shattering when perforated. Affords little danger of intrusion of water from below or gas from above.

LOW FLUID LOSS—Permits low water content. Practically eliminates danger of incomplete shut-off due to shrinkage and flash-setting due to dehydration.

PERMANENCY—Cealment has extra resistance to sulphate brines without sloughing—provides durability.

RESISTANCE TO CONTAMINATION—Cealment assures better resistance to any acid or other well fluids that may be introduced later into a perforated zone.

Consult your Dowell representative for specific recommendations; in Venezuela, contact United Oilwell Service. Or write Dowell Incoporated, Tulsa 1, Oklahoma.

*Service Mark of Dowell Incorporated

NEW in 1955—PROVED Today! Check just a few of the results made possible with Cealment.

DEPTH	PROBLEM	RESULTS
1588'	To prevent water communication on primary cement job.	265 gallons Cealment. Perforated and fractured; made 30 BOD, no water.
1900'	To set liner and isolate water.	975 gallons Cealment. Liner held. Fractured successfully.
2300'	Squeeze hole in casing after three previous squeeze jobs.	500 gallons Cealment. Hole repaired.
6355'	To squeeze channel for water shut-off, for recompletion.	500 gallons Cealment. Channel repaired.
4059'	To regain lost circulation.	750 gallons Cealment. Drilled out Cealment. Regained circulation and continued drilling.
4660'	Tail-in behind primary cement job.	275 gallons Cealment. Producing zones successfully isolated.

Services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

What's Happening

AMONG MEN IN THE INDUSTRY

Ralph G. McIntyre, chairman of the board of **Standard Oil Company of Texas,** and president of Pasotex Petroleum Company and Pasotex Pipe Line Company, retired at the end of January, 1957, after being associated with the parent company, Standard of California, and its subsidiaries for over 46 years. McIntyre joined Standard of California in 1910 as a clerk in the Accounting department at their Richmond Refinery. In 1921 he had risen to the office of the assistant auditor of the Manufacturing department of that Company. In 1928 he came to Texas as auditor of the Pasotex Petroleum Company and the Pasotex Pipe Line Company, Standard's subsidiaries, headquartered at El Paso. He was made assistant general manager of Standard Oil Company of Texas in 1935 and was elected a director and secretary and treasurer of that company in 1941, a vice president in 1942, and president in 1946. He held the office of president until 1955 when he became chairman of the board.

Ralph G. McIntyre

•

C. A. Lehnertz and **J. H. Gosney,** staff geologists with **Doeringsfeld, Amuedo and Ivey,** Denver, are in Jamaica on a six month assignment. The firm is also conducting photogeological evaluation surveys in South America and Africa.

•

Raleigh Warner, Jr., has been appointed manager of the Economics department of **Socony Mobil Oil Company, Inc.,** and a member of the company's coordination committee. He succeeds **Albert J. McIntosh,** who joins the Public Relations department as a consultant. McIntosh was first employed by the company as an office boy 44 years ago. Warner entered the oil industry in 1948. He came to the Socony Mobil organization in 1953 as assistant to the vice president and director of finance of Socony-Vacuum Overseas Supply Company, Inc. In 1954, he was appointed treasurer of Socony-Vacuum Overseas Supply Company. When Mobil Overseas Oil Company, Inc., was organized on January 1, 1956, he was made its assistant treasurer. He was transferred to the Economics department of the parent company in April, 1956.

•

Continental Oil Company has promoted three key men to new positions in their Exploration and Foreign departments. The men, all of whom will continue to make their headquarters in Houston, are: **Howard H. Hinson,** administrative vice president, was promoted to vice president and general manager of the reorganized and expanded Foreign department. **James S. Royds,** assistant manager of the Foreign department, was promoted to general manager of the Exploration department, assuming domestic and Canadian exploration duties formerly held by Hinson. **S. K. Clark,** a member of Conoco's Exploration and foreign departments for more than 32 years, was promoted to the newly created position of assistant to the vice president and general manager of the expanded Foreign department.

•

Frankfort Oil Company has announced the appointment of **Dolphe E. Simic** as exploration manager and **Thomas P. Brooks** as production manager. Simic was vice president in charge of exploration for the Bay Petroleum Company. More recently he was associated with Halbert, Jennings & Simic, oil producers, Denver, Colo. Brooks was the general production superintendent for the Southern Production Company, Fort Worth, Texas, before joining the Frankfort organization. Brooks has also been associated with Lion Oil Company.

•

Magnolia Petroleum Company Producing division announced these changes effective Jan. 1, 1957. The Producing department headquarters for the Lea district will be established in Hobbs, N. M. This district will be composed of all producing operations within New Mexico. **W. C. Dougherty** will be district superintendent and **J. M. McLaughlin** will take over Dougherty's duties as management assistant, employe relations in the Dallas office. **Charles T. Evans,** petroleum engineer in the Kermit district, will be promoted to district petroleum engineer in charge of the new Lea district in Hobbs. **Thomas R. Perfect,** chief clerk in the Kermit district, will be transferred to the Lea district and **E. Jack Kennon** will take his place at Kermit. **Hugh D. Clark,** chief clerk at the Vanderbilt Producing district, has transferred to the Luling district replacing **H. A. Pressler** who will retire in February. **Ernest H. Murphy** is now chief clerk at Vanderbilt.

•

William J. Abnett was appointed an assistant project engineer in **Sun Oil Company's** Manufacturing department. He previously served as assistant technical advisor on natural gas and natural gasoline projects in Sun's Production department in Philadelphia. Abnett's new duties will concern plant construction supervision. Additionally, he will specialize in boiler installations, steam and power systems, circulating water systems and installation of cooling water towers. He will work in a project group headed by **George E. Cook.** He joined Sun in May, 1949, as a special assistant in the Natural Gas department in Philadelphia.

•

J. J. Hohler has been named division exploration manager of **Shell Oil Company's** newly-created Marine Exploration division. The new division, to have headquarters in Houston, will direct Shell's exploration activities off the Texas Gulf Coast. **P. L. Terrasson** has been named division geophysicist for the new marine group. Hohler joined Shell as a geologist at Houston in 1951. He was transferred to Baton Rouge, La., in 1952, and at the time of his present promotion was serving as a geologist in New Orleans. Terrasson began working for Shell in 1948 as a junior geophysicist in Houston. He was geophysicist in charge of marine geophysical information prior to his new assignment.

•

Henry E. Winter has joined the executive office of **International Petroleum Company, Ltd.,** in Coral Gables, Fla., as Venezuelan coordinator. Winter transferred to International Petroleum from the Producing Coordination department of Standard Oil Company (New Jersey), where he was regional executive for South American producing. He started his oil career when he joined Standard Oil Company (Indiana) as a sample boy in the Casper refinery. He worked as a chemist for The Texas Company in its refinery in Casper from 1934 until late 1935. From 1935 to 1939 he was employed as an engineer with Lago Oil and Transport Company in Aruba. In 1939 Winter transferred to Standard Oil Company of Venezuela's Coordination department. He remained with Jersey Standard affiliates in Venezuela from 1939 until 1954 and held a number of important positions with Creole Petroleum Corporation in Venezuela, including that of manager of the Economics department and manager of the Western division. In 1954 he joined the Producing Coordination department of Standard of New Jersey in New York.

Henry E. Winter

•

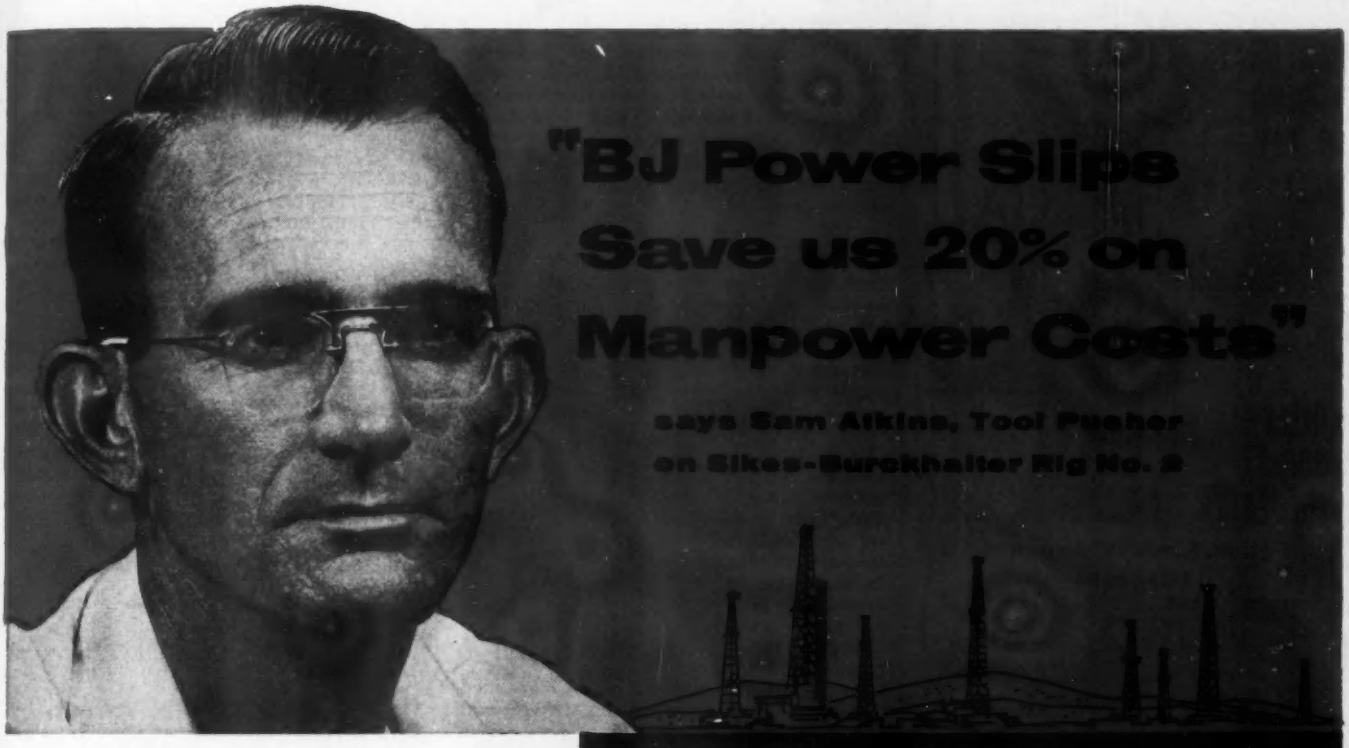
Dwight H. Seely, Jr., was promoted from exploration manager (acting) to exploration manager of the Gulf Coast division for **Sohio Petroleum Company.**

•

Allen B. Walters, treasurer of **Federal Oil Company** has been elected a trustee of Ironbound Manufacturers Association of Newark, N. J.

•

The Texas Company announced the election of **Oscar John Dorwin** as a director and **Theodore A. Mangelsdorf** as a vice president. Dorwin has been a vice president since 1951 and general counsel since 1944. As a director, he will replace **R. F. Baker,** executive vice president of the company, who retired February 1. Mangelsdorf was named general manager of the domestic Refining department in July, 1954. Dorwin became associated with Texaco in 1931 when that company ac-



"BJ Power Slips are the prime reason for our using only 4-man crews, even on deep holes.

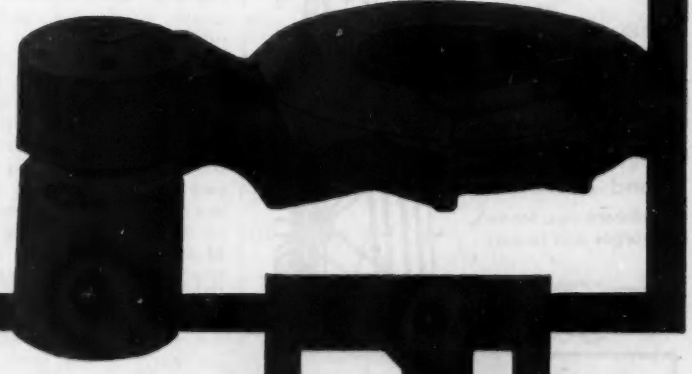
"Our crews like BJ Power Slips because they eliminate the setting and pulling of hand slips on round trips . . . which any roughneck can tell you is hard work. With the BJ Power Slip the men stay fresher, and get us back on the bottom faster, ready to make hole.

"Safety is also a big point. We don't have to worry about the whirling handles of hand slips. And crews are clear of the moving pipe and elevator because slip operations are controlled by the driller.

"As a tool pusher I like the fact that these slips don't have to be stripped on and can be swung out of the working area when not in use. Also they have a full opening to pass drill bits, reamers, drill collar stabilizers and centralizers."

Big Benefits of BJ Power Slip

- The only power slip that can be unitized with a rotary table . . . *installed and moved as a unit!*
- Side opening allows the BJ Power Slip to be quickly closed around or removed from the pipe.
- Pressure raised and pressure set by foot pedal control by driller – *automatically* pressure centers the pipe in the table.
- Moves out of the way during drilling. The BJ Power Slip swings away from the rotary table and can be positioned out of the working area.
- Automatic safety features. A built-in pressure relief valve automatically relieves air pressure in power cylinder if elevator accidentally strikes arm ring of Slip. A pilot-operated safety valve automatically holds Slip in "up" position in the event of an air line failure.



Byron Jackson Tools, Inc.

A Subsidiary of Borg-Warner Corporation

P. O. Box 2017A Terminal Annex, Los Angeles 54, California

***Export Address:* 580 Fifth Avenue, Suite 510, New York 36, New York**

Offices in Houston, Fort Worth, Denver and New York. Sales Engineers in all Principal Oil Fields.

BJ

PERFORATE TUBING IN THE WELL

KINLEY TUBING PERFORATOR

M. M. Kinley Company
Licensees

ABILENE, TEXAS
Hudson-Eads, Inc. 2-5331
BEAUMONT
ASEECO .....5-7046, ZF 8-2023
CASPER
C. A. White.....3-5264
CORPUS CHRISTI
Tubokut Wireline Services.....5-1811
HOBBS
Cecil Horne 3-5396
MIDLAND
Lucecus Service & Eqpt.....2-1631
NEW ORLEANS
ASEECO AU-7698
OKLAHOMA CITY
Rainbo Service Co.....ME 4-2131, ME 2-2024
LIBERAL, KANSAS
Rainbo Service Co.....Main 4-3598
PETTUS, TEXAS
Eddie Jones Engineering Co..16 or Beeville 1547
WICHITA FALLS
Hudson-Eads, Inc.....2-3767, 2-8584, 3-4690
WHITTIER, CALIF.
Kline Wire Line Co.....OXford 3-2731

INGALLS

Offshore Drilling Rigs

Consult a Specialist in DESIGNING and BUILDING offshore rigs, tenders, barges and tankers

THE INGALLS SHIPBUILDING CORPORATION
BIRMINGHAM, ALABAMA

quired the Indian Refining Company, of which he was general counsel. Mangelsdorf joined Texaco in 1933 as chemical engineer. He served as superintendent of Texaco's Port Arthur, Texas, and Lockport, Ill., refineries, and as manager of the Refining department's Operations division, prior to becoming general manager of that department.

•

Earl V. Hewitt was appointed division production superintendent for **Stanolind Oil and Gas Company's** North Texas-New Mexico division. Formerly with Pan American Production Company in Houston, Hewitt succeeds **Charles F. Bedford,** whose transfer to Tulsa and promotion to general superintendent of the Producing department at Stanolind's general office was previously announced. Hewitt had been with Pan American since its formation in 1935. He joined the company as a field foreman in Texas and Louisiana. In 1938, he was named general superintendent of production, with offices in Houston, and in 1951, he was elected vice president in charge of production.

Earl V. Hewitt

•

Cities Service Oil Company has reorganized the West Texas area into two districts. All properties north of Odessa are to be consolidated into the North Odessa district, with **A. P. Coe,** named to the post of district superintendent. **C. T. Kemerling** is district clerk. The new south Odessa district has **O. B. Seay** as district engineer and **W. E. Stancoff** as district clerk. **R. E. Groves** of Odessa has been promoted to division clerk for West Texas production operations and will supervise clerical work of both West Texas districts. The entire West Texas area is under the supervision of **D. D. Bodie,** division superintendent of all the company's West Texas-New Mexico production operations.

•

William W. Clawson, president of **Mobil Producing Company** and **Mobil Oil of Canada, Ltd.,** became coordinator of domestic production and a member of the producing committee of the parent company, **Socony Mobil Oil Company.** Replacing him as president in the two posts at Mobil Producing headquarters in Billings, Mont., will be **Edward C. Cram,** presently coordinator of domestic production. Clawson, who has directed the activities of the two exploration and producing affiliates since 1952, joined Socony Mobil in 1933 as a geologist for its Southwest affiliate, Magnolia Petroleum Company. He was chief geologist of Magnolia from 1946 to 1952. Cram, who has been coordinator of domestic production since 1953, joined the company as a geologist in 1936. In his early years with Socony Mobil he worked both in Venezuela and Colombia. From 1941 to 1951, he served as a geologist for Magnolia, the last five years as coordinator of exploitation in the headquarters office, Dallas. He came to Socony Mobil's headquarters in New York in 1951 where he was assistant coordinator of domestic production prior to being named to his present post.

Vernon A. Bellman, domestic marketing manager of **Socony Mobil Oil Company, Inc.,** has been elected a member of the board. He succeeds **Herbert Willetts** as director in charge of domestic marketing. Willetts, who will retain responsibility for the company's Petroleum Chemicals department, will in addition take the portfolio of employe relations which has been held on a temporary basis by **J. C. Case** since the retirement of **C. Francis Beatty.** Case retains his other duties in connection with producing.

•

Clarence Eugene Whipp, Jr., has joined **Trunkline Gas Company** of Houston as district geologist for the southern Louisiana district. His headquarters will be at Lafayette, La. He joined Trunkline Gas from Highland Oil Company. His prior experience in the geological field included five years as a geologist with Sohio Petroleum Company and work with the Louisiana Geological Survey.

•

Penrod Drilling Company announced the appointment of **J. P. (Jack) Johnson** as drilling superintendent in Shreveport, La.

•

Monterey Oil Company recently appointed **Harry H. Sisson** to chief geophysicist. In his new post, Sisson will maintain headquarters in Los Angeles and will be responsible for the company's entire seismic exploration program. In 1930 he worked on a survey crew for Humble Oil & Refining Company. Later he served some six years as seismologist for Humble, and five more as a seismic party chief for General Geophysical Company. He came to Monterey from the Robert H. Ray Company of Houston for which he had officiated during the past five years as chief seismologist.

•

Edward B. Wasson, Cosden Petroleum Corporation's former division geologist in Denver, has been promoted to manager of the Rocky Mountain division. He replaces **J. S. Cosden, Jr.,** who resigned from the company recently. Before joining Cosden two years ago as division geologist, Wasson spent six years with The California Company as geologist and geophysicist. **Robert R. Berg** was made division geologist in Denver. He was employed the past five years as a geologist for a major oil company.

Edward B. Wasson

•

Murphy Corporation has announced that **Eugene E. Kincaid,** reservoir engineer for the company in El Dorado, Ark., was promoted to the position of divisison engineer with headquarters in the Shreveport, La., division office. Kincaid joined Murphy in March, 1955. Prior to that time, he was employed by The Carter Oil Co. as district reservoir engineer in Carmi, Ill.

•

John C. Price and **Henry H. Krusekopf, Jr.,** have recently formed a partnership and opened a geological consulting office in Tyler, Texas. Their office is located in 574 Fair Foundation building. Price

Axelson Rods-

"...the Boss sure likes 'em!"

We're forever ordering Axelson sucker rods. We're getting deeper wells now, and that J&L Supply man who came in today to talk about Axelson rods sure did all right for himself — and us!

He and the Boss tossed around a lot of weird jargon about uniform strength, ductility, corrosion and shock resistance, rod types, chemical and physical properties, peak stresses, rod string selections, tapered strings, and so on endlessly.

Then the J&L Supply man got out what he called a "rod comparison chart" and a lot of catalogs and things and everybody present seemed to have a wonderful time.

The Boss said the man was really helpful. At any rate here goes another order to J&L Supply for Axelson rods — and it's the biggest yet!

Jones & Laughlin

SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

31-G

has worked for Magnolia Petroleum Company and Lion Oil Company in Tyler and most recently held the position of regional geologist for Lion in Shreveport, La. Krusekopf has worked for Magnolia in Roswell, N. M., and Tyler and was a district geologist for Pubco Petroleum Corp. in Roswell and Aztec, N. M.

•

A. M. Bleiler, senior vice president of **First California Company** was elected a director of **Southern California Petroleum Corporation.**

•

Edward A. Krieg, Jr., formerly chief geophysicist for **Southern Production Company** in Fort Worth, Texas, has opened his consulting office in New Orleans. Krieg was with Sidney Schafer & Co. in Houston prior to joining Southern Production in 1952. His background of experience extends from Canada to Venezuela, and includes some Middle East work as well as prewar seismic exploration in the East Indies.

Edward A. Krieg, Jr.

•

Henry L. Waszkowski, assistant to the coordinator of domestic production, **Socony Mobil Oil Company,** became assistant to the manager of the company's Producing department. A petroleum engineer, Waszkowski has been with Socony Mobil for 17 years, the first 14 of which were with Magnolia Petroleum Company, the company's affiliate in the Southwest. Prior to coming to New York in 1953 as assistant to the coordinator of domestic production, he was assistant superintendent of Magnolia's Producing district headquarters at Falfurrias, Texas. For a time during the Korean war he was assistant director of the Production division of the Petroleum Administration for Defense in Washington.

•

Sun Oil Company has formed a new sales region with headquarters at Syracuse, N. Y. The new region, called the Empire State region, will be headed by **James E. Banta,** formerly general manager of the Company's Motor Products department. It will cover an area predominantly in upper and western New York state and will include five Sun sales districts centered at Albany, Binghamton, Buffalo, Rochester and Syracuse. The Company has seven other sales regions in the northeastern U. S. and Florida. The sales territory embraced by the new region was formerly under the jurisdiction of Sun's New York regional office headquartered in New York City. The latter region will continue to cover New York City, its surrounding areas and northern New Jersey. Banta joined Sun as a service station salesman in 1932. After serving as a motor products salesman and later branch manager at Marcus Hook, Pa., he was named district manager at Philadelphia. He was then appointed merchandising manager for Sun's Middle Atlantic region and in 1951 he was named assistant manager of the Company's Central region, headquartered at Pittsburgh. He became general manager of the Motor Products department in 1953.

E. Dumont Ackerman has joined the Executive office of **International Petroleum Company, Limited** in Coral Gables, Fla., as exploration coordinator. Ackerman transferred to Coral Gables from International Petroleum (Colombia) Limited in Bogota, Colombia, where he was exploration manager, and later acting general manager. In 1935 he accepted the position of junior geologist with an affiliate of Standard Oil Company (New Jersey) in Venezuela, which later became Creole Petroleum Corporation. He held various positions with Creole in Venezuela, including that of district geologist in the Temblador, Quiriquire and Jusepin districts; assistant division geologist of the Western division in Maracaibo; and division geologist of the Eastern division in Caripito. In 1951, Ackerman transferred to International Petroleum (Colombia) Limited in Bogota to become exploration manager.

E. Dumont Ackerman

•

C. A. Wiggins, president of **Drilling & Exploration Co., Inc.,** has resigned his position on the board of directors. He stated that he was taking this action at this time for purely personal reasons. The board of directors at a special meeting elected **Charles R. Rider,** now chairman of the board and chief executive officer,

Are you drilling a Wildcat Well?

PROVEN GEOPHYSICS

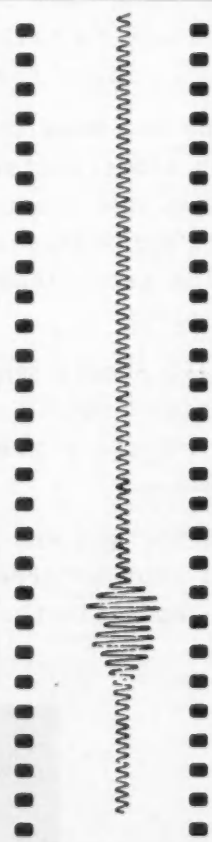
The New and Improved Amazing Attractometer

The latest and most modern method of geophysical exploration that shortens the route to petroleum reserves by rigid instrumental recordings, indicating the existence or not of hydrocarbon accumulations, and approximate depth. Ten locations for a major oil company without error. Surveys conducted for cash fee and chance to earn small override, oil payment, leases or other interest, where saturation is indicated in commercial quantities. Information on request.

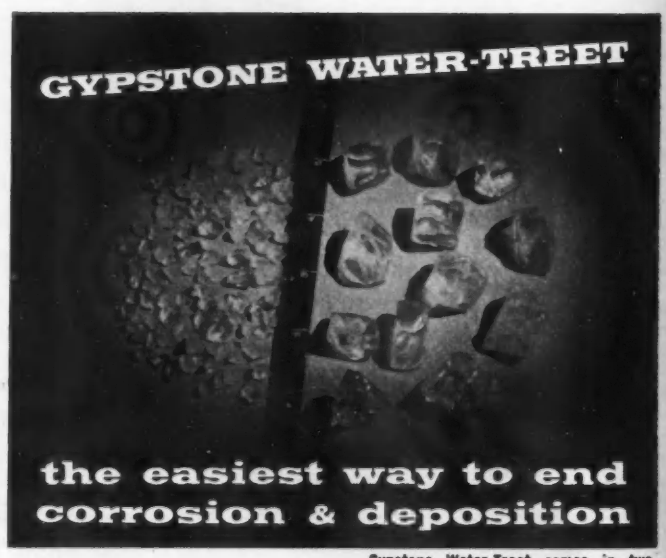
To establish conclusive proof of the accuracy of our geophysical work, we will, without cost to you, test and record a log of your well on tape, bearing your signature and ours, of your rank wildcat location, in advance of drilling, indicating the existence or not of petroleum in commercial quantities underlying the tested areas and approximately at what depth it may be found. The instruments are entirely self-operating during testing period.

GEOPHYSICAL SURVEY SYNDICATE

4133 Sunnyslope, Sherman Oaks, Calif. Phone STate 46903



Specimen of log tape indicating saturation with break in zone



- Simple and convenient to use
- No added application expense
- Conveniently packaged in air-tight 100 lb. metal containers
- Economically priced
- Cuts operation costs
- Increases productivity

Gypstone Water-Treet comes in two sizes — 1/2" lumps for 7" OD casing and 1/4" lumps for 5-1/2" or 7" OD casing.

A scientific blend of phosphate chemicals, Gypstone Water-Treet overcomes corrosion and water precipitates without harm to water, oil or equipment. Harmless to handle or breathe. Available through most supply stores, or contact

Mid-States Chemical Co. Inc.

P. O. BOX 306 MT. VERNON, ILLINOIS PHONE 4310

"Chemicals for the Oil Industry"

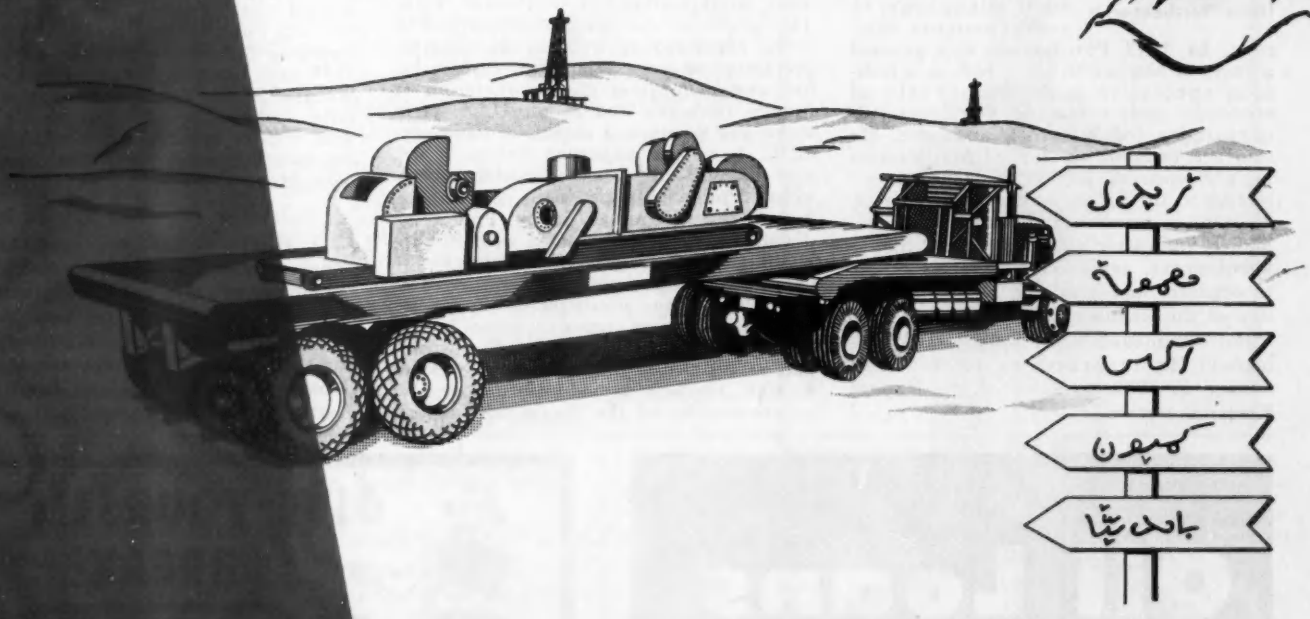
6921

EIDAL

Builders of the World's Largest TRAILERS

with capacities up to 300 tons

IN THE MIDDLE EAST



NOW OVER 1000 EIDAL BUILT AND DESIGNED TRAILERS AT WORK IN THE OIL FIELDS OF THE MIDDLE EAST.

EIDAL

"BUILDERS OF THE WORLD'S LARGEST TRAILERS

EIDAL engineers are experienced specialists in the building of off road trailers to meet buyers' requirements—saves you time—saves you money . . .

EIDAL manufacturing company

POST OFFICE BOX 1379

ALBUQUERQUE, NEW MEXICO

NOW IN SERVICE IN

AUSTRALIA VENEZUELA CENTRAL AMERICA
EGYPT TUNIS ALGIERS PERU
SAUDI ARABIA UNITED STATES PHILIPPINES

Write or wire us now. We will have one of our transportation engineers discuss your problems with you . . . or . . . we will send you complete information.

to the presidency to succeed Wiggins. Wiggins has agreed to remain with the company for a period of three years in a consulting capacity.

•

Harry Pforzheimer, Jr., a member of **The Standard Oil Company (Ohio)** home office Finance department since 1950, has been appointed assistant to **A. E. Wolf**, vice president in charge of finance. Pforzheimer, an employe of the company for the past 18 years joined Sohio's Manufacturing department at the home office in 1938 as a junior engineer in the Technical Service division, later advancing to senior process engineer. In 1943 Pforzheimer was granted a leave of absence to serve first as a technical specialist and subsequently as economic analyst for the Petroleum Administration for War in Washington. He returned to Sohio as chief of Manufacturing's Economics section in 1946, transferring to the Finance department as staff assistant in research and analysis in 1950. Shortly thereafter he accepted a 12 month appointment, again on leave from Sohio, to organize and head the Economics section of the Refining division of the Petroleum Administration for Defense in Washington. He returned to home office finance in 1952, as chief of the Capital Research section.

Harry Pforzheimer, Jr.

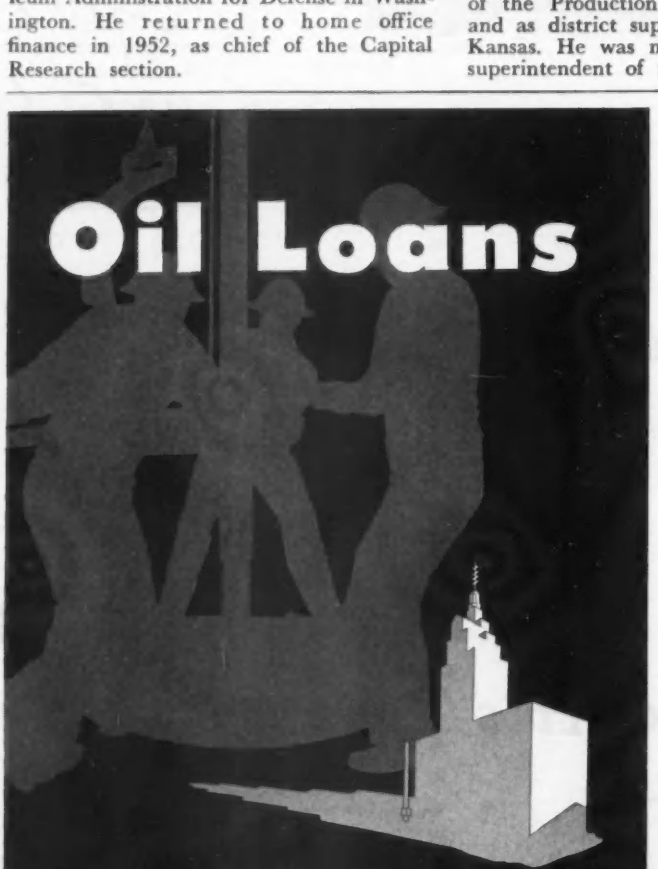
William M. Holaday, formerly head of the research and development activities of **Socony Mobil Oil Company, Inc.**, left the company effective Feb. 1, 1957, to become deputy assistant secretary of defense (Research and Development). Holaday has been on leave of absence from the company since Feb. 1, 1956, serving in this capacity, with headquarters in Washington, D. C.

•

Phillips Petroleum Companay has made several promotions involving key management posts. **John M. Houchin** was elected vice president, with duties relating generally to over-all company activities but with primary responsibilities relating to the Production and Foreign departments. **Harry G. Fair** succeeds Houchin as chairman of the Operating committee, and **W. C. Hewitt** succeeds Fair as vice chairman of this committee. **Harry D. Brookby** becomes manager of the Foreign department, headquartered in Bartlesville, Okla. The scope of the foreign department is being expanded to include all activities pertaining to negotiations for, exploration for, and acquisition of raw materials in foreign countries and in all U. S. territories and possessions outside of Continental U. S. and its adjoining waters. It will also include present Venezuelan operations. Producing operations in Canada and Alaska will remain in the Production department. Houchin started with Phillips at Oklahoma City in 1933 and worked in engineering capacities in several areas of the Production department. He later served as assistant superintendent in two of the Production department's districts and as district superintendent in western Kansas. He was named assistant general superintendent of the Production department in 1944 and served in that capacity until 1951 when he became general superintendent. He was advanced to chairman of the company's Operating committee in February, 1956. Fair joined Phillips in 1939 as a chemical engineer and served continuously in the Refining department until 1953. He was assistant to the department manager from 1945 until 1947 when he became assistant superintendent of Phillips Kansas City, Kansas, refinery. In 1951 he advanced to superintendent of the refinery and in 1953 returned to Bartlesville as vice chairman of Phillips Operating committee. Hewitt joined Phillips in 1935. He worked in the Natural Gasoline department in various engineering capacities and at Plains Butadiene plant, Borger, Texas, in operations supervision, becoming plant manager in 1950. A year later Hewitt was made superintendent of operations for Phillips Chemical Company and in 1955 he advanced to assistant general manager of this subsidiary. Brookby started with Phillips as a geologist in Wichita Falls, Texas, in 1938. He transferred to Bartlesville as senior geologist in 1948 and later became division geologist. Since 1954 he has been manager of the Land and Geological department's Southwest region, covering the Texas Panhandle, north central and West Texas and New Mexico.

•

J. D. Perryman has been appointed divisional exploration manager of **Tidewater Oil Company's** Central division with headquarters in Tulsa. In his new capacity, Perryman will be responsible for directing and coordinating the operations of the Geological, Geophysical and Land departments. He has been associated with the


Oil Loans
NATIONAL BANK OF TULSA
The Oil Bank of America
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION
OFFERING COMPLETE BANKING AND TRUST SERVICES

GIVE YOURSELF A BREAK!
with BrakeSol
HOLDS PARAFFIN IN SUSPENSION
from FORMATION to REFINERY
Now is the time to give yourself a break with BrakeSol and clean the paraffin from your production system. Then keep it clean by setting up a program of constant treating.
FORMATION. Get more production by cleaning up the formation with BrakeSol. Use with frac jobs to get more effective results.
HEATER-TREATER. BrakeSol will allow the use of less heat, thereby increasing the gravity of your oil.
TANKS. Clean up that tank bottom by treating it back into the oil where it can be sold. Equally effective on the largest pipeline tank and the smallest stock tank.
CARMI, ILLINOIS 4-2905
CASPER, WYOMING 2-3453
GREAT BEND, KANSAS 4285
FT. MORGAN, COLO. UNderhill 7-6389
HOUSTON, TEXAS HOmestead 5-6648
LOVINGTON, NEW MEXICO 6-5954
NEW IBERIA, LOUISIANA EMerson 9-3498
ODESSA, TEXAS FE 7-7192
ARDMORE, OKLA. 6489
OKLAHOMA CITY, OKLA. VI 3-6629 WH 9-5561
CONTACT YOUR NEAREST BRAKESOL TREATING ENGINEER
Your BrakeSol Treating Engineer can show you the most effective methods of application and how to accomplish all of the above in one simple operation. Make money and save trouble this winter by the use of BrakeSol.
• Export Distributor: The National Supply Co.
Export Division 600 Fifth Avenue
New York, New York, U.S.A.
BRAKESOL, Inc.
P.O. Box 9506 Okla. City, Okla.

NOW you can enter against pressure for Corrosion Control

Safely...Economically!

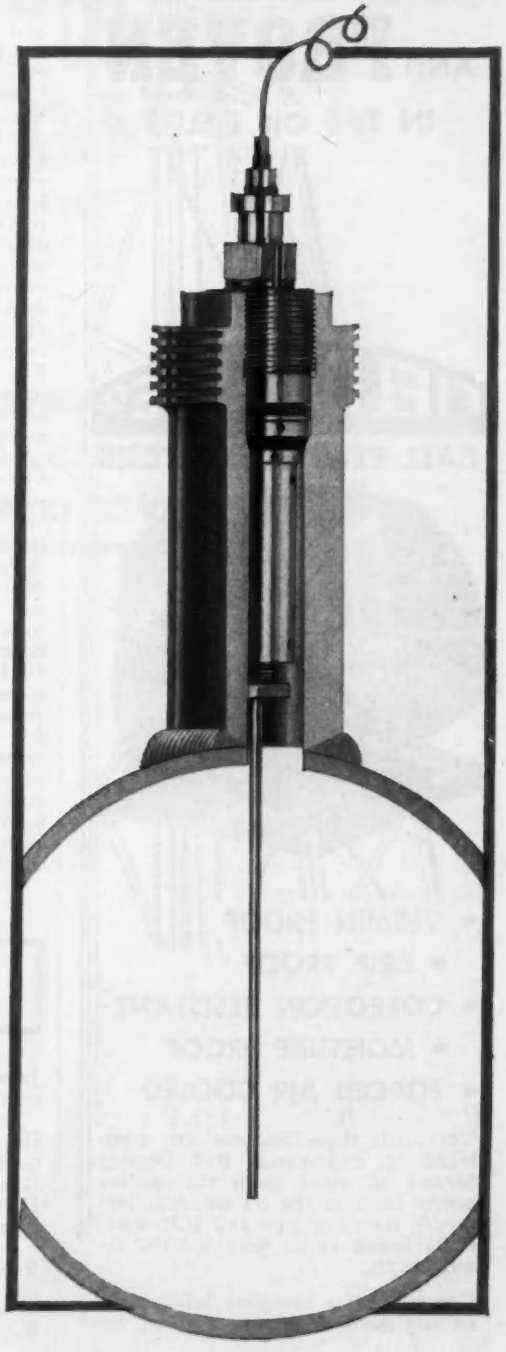
Without interfering with operations, you can now go into vessels and pipe lines on stream to investigate corrosion, its rate, cause and effects. This is possible when COSASCO *Access* Nipples are installed at strategic locations as pressure-proof ports for the insertion of coupons and to secure data with water samplers, thermocouples and hydrogen probes.

While coupons continuously provide means of recording rate of corrosion, samplers permit periodic analysis of possible causes, thermocouples contribute desired temperature readings and the hydrogen probe helps to determine the concentration of free hydrogen present. With such information at hand, intelligent application of measures for control can be made to prolong equipment service life, reduce or eliminate product pollution and, consequently, protect important capital investment. In many cases, product quality can be more easily maintained.

COSASCO *Access* Nipples may be installed at any time: either during shutdown or, with a COSASCO Hot Tapping Assembly, while vessel or line is under full operating pressure.

The *Access* Nipples have removable low-carbon type 303-304 stainless steel plugs. Special plugs for the samplers, thermocouples, and hydrogen probes are also of this highly corrosion-resistant material. COSASCO *Access* Nipples are applicable to any pressure or storage system, hydraulic or gaseous.

COSASCO



THERMOCOUPLE *ACCESS* PLUG

Here a Thermocouple Plug is shown in place in an *Access* Nipple welded to a tapped pipe line. The closed-end tube extending into the line contains the iron-constantine wire inserted through the plug. The entire assembly is completely pressure-proof. Plugs fitted for water sampling and probing for hydrogen are basically similar. Details will be supplied on request.

What's your problem?

If it's an entry-against-pressure problem, COSASCO engineers invite you to submit details. Send blueprints or drawings to depict the problem, and the COSASCO solution will be supplied *without charge*. You will be under no obligation whatever for this service.

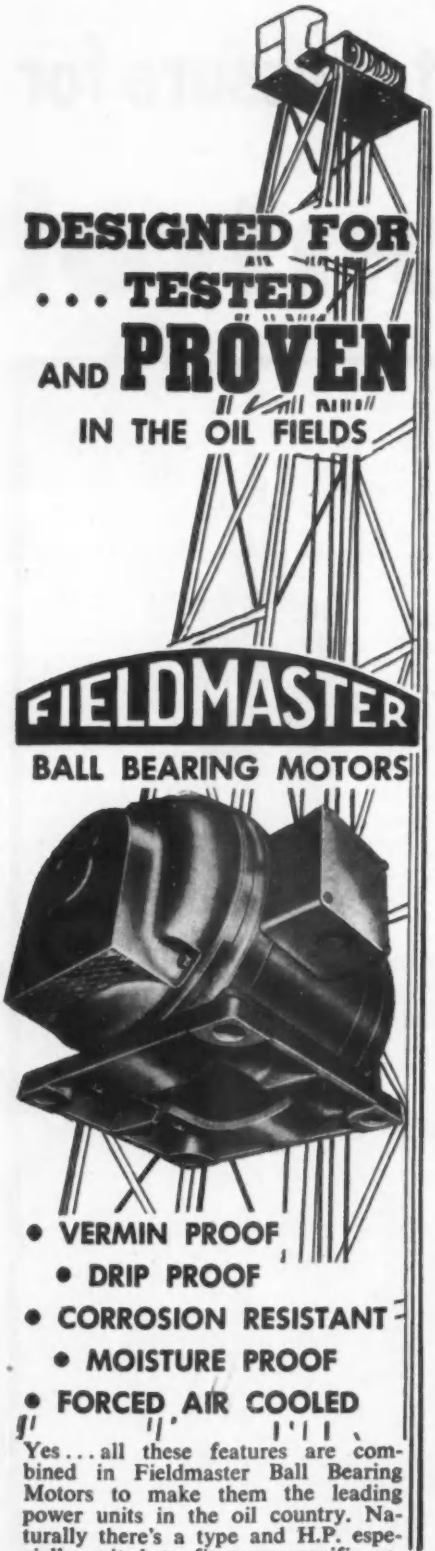
Protect equipment . . . Save product

COSASCO

Division of
Perfect Circle Corporation

3463 Ocean View Boulevard, Glendale 8, California

Address Mail to P.O. Box 277, La Canada, California • Export Office: 617 S. Olive Street, Los Angeles 14, California



Yes . . . all these features are combined in Fieldmaster Ball Bearing Motors to make them the leading power units in the oil country. Naturally there's a type and H.P. especially suited to fit your specific requirements.

Contact us for complete information on any motor requirement.

BETHLEHEM SUPPLY COMPANY
TULSA, OKLAHOMA
Manufactured by
VALLEY ELECTRIC CORP.
ST. LOUIS 8, MISSOURI

Tidewater Oil Company operator activities in Saskatchewan for the past year. Prior to that he was president and director of the Geotechnical Service Corporation of Dallas.

•

Chalmer G. Kirkbride joined **Sun Oil Company** as executive director of the Research, Patent and Engineering departments. In accepting the new position at Sun, Kirbride resigns as president and chairman of the board of directors of Houdry Process Corporation, Philadelphia. **Dr. Charles L. Thomas** was appointed director of the Research and Development department. Dr. Thomas, formerly associate director of research and development, replaces **Dr. J. Bennett Hill** whose retirement was previously announced. Kirkbride joined the Research department of Standard Oil Company (Indiana) that year and left in 1934 to become assistant director of research for Pan American Refining Corp. In 1942 he joined the Magnolia Petroleum Company as chief of chemical engineering development. In 1947, Kirkbride became manager of research and development at Houdry Process Corporation's laboratories in Linwood, Penn. A year later, he was named vice president in charge of Houdry's Research and Development division and a director, and in 1952 was appointed president and chairman of the board of directors. Dr. Thomas is well known in the oil industry as the author of more than two dozen articles and over 100 patents. In 1931 he joined Universal Oil Products as a research chemist, and later was appointed associate director of Research. He left UOP in 1945 to become director of research with Great Lakes Carbon Corporation. Starting with Sun in 1951 as a staff assistant in the Research and Development department, Dr. Thomas was named associate director of the department in 1953.

Chalmer G. Kirkbride

DEATHS

James Burt Stoddard, 70, independent oil operator, died December 26.

Harry Everett Butcher, Sr., 64, general credit manager for Cities Service Oil Company, died December 27 in Chicago. He had been with Cities Service for more than 40 years.

Robert W. Haiges, 56, geologist with Phillips Petroleum Company, died December 27 in a Tulsa hospital. He had been with Phillips for 30 years.

Nathan P. Isenberger, 60, foreign consultant to the Phillips Petroleum Co. executive staff, died December 21 at his home in Bartlesville, Okla. He joined Phillips in 1933 and had served in Texas, Mexico, South America and the Middle East, becoming foreign consultant in 1950.

Alden B. Rowley, 68, independent consulting geologist, and former chief geologist for Continental Petroleum Corporation and the Peters Petroleum Corporation, died December 21.

George Albert Simons, 84, pioneer oil man, died December 12.

William Richard Calhoun, 57, technical laboratory engineer with Cities Service Oil Company, Chicago, died December 12.

C. W. Binckley, 45, in the Natural Gas department of Phillips Petroleum Company, died in a plane crash near Bartlesville, Okla., December 12.

William C. Reed, 37, in the Natural Gas department of Phillips Petroleum Company, died in a plane crash near Bartlesville, Okla., December 12.

Donald Young, 31, in the Natural Gas department of Phillips Petroleum Company, died in a plane crash near Bartlesville, Okla., December 12.

D. F. Mayfield, 49, in the Natural Gas department of Phillips Petroleum Company, died in a plane crash near Bartlesville, Okla., December 12.

A. M. Rippel, 61, head of the Natural Gas department of Phillips Petroleum Company, died in a plane crash near Bartlesville, Okla., December 12. He joined Phillips in 1925. Before that time he was an engineer with Empire Gas and Fuel Company.

William Clers O'Ferrall, 74, independent Louisiana and Arkansas oil operator died at his home in Shreveport, December 5.

W. G. Selby, 72, vice president of the old Selby Oil and Gas Company in Sarasota, Fla., died at Sarasota December 4. Selby was vice president of the Selby firm until it was consolidated with The Texas Company in 1942.

George F. LeBus, Sr., 50, died December 29 in Wichita Falls. He was the founder of the LeBus Rotary Tool Works, manufacturers of drilling tools.

Harry J. Glauser, Sr., 61, died January 16 at his office in Houston. He was president and one of the founders of the Staytite Company which was organized in 1927. Before joining Staytite he was an employe of The Texas Company. He had been active in several civic organizations in Houston.

Anthony Folger, died in an air-line crash near Vancouver, British Columbia, December 9. He was a senior oil geologist with DeGolyer & MacNaughton.

John Whitten Hammond, 73, independent Tulsa oil man died December 19.

Elmer W. Wails, geologist-scout in the Shreveport, La., area for Midstates Oil Corporation, died Devember 17.

Joseph D. Davis, 72, pioneer independent oil producer and oil well supply dealer, died at his home in Tulsa, January 8. He was chairman of the board of the Producers Pipe and Supply Co.

GRAVEL PACKING IS THE ANSWER TO DIFFICULT SAND PROBLEMS . . . . . WHEN DONE RIGHT

THE ORIGINAL METHOD AND STILL THE BEST FOR SAND CONTROL

THE LAYNE GRAVEL PACK

has proven conclusively that it will control sand, lengthen the life of a well and save many expensive work-over jobs. Long experience, the proper equipment and the correct size gravel assures maximum results.

WRITE — WIRE — PHONE

THE LAYNE AND BOWLER COMPANY

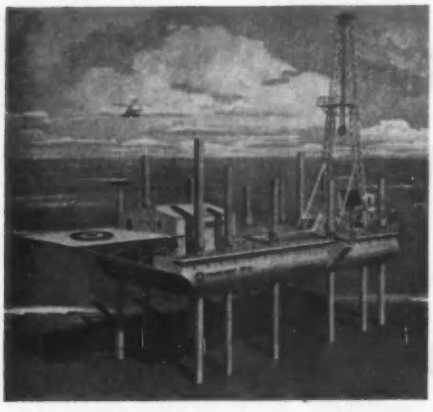
P. O. BOX 1327
7800 MARKET ST.

General Office and Factory
HOUSTON 1, TEXAS

TELEPHONE
OR 2-7561

For more data on advertised products, use Readers' Service Cards, last page.

Companies in the News



Trans-Gulf's drilling platform.

TRANS-GULF OFFSHORE DRILLING, INC., will acquire a mobile drilling platform for drilling in the Gulf Coast and will possibly drill for their own company. The officers of this new company, incorporated within the laws of the State of Texas are: **Drennan O. Wade,** president and director; **Harry J. Chavanne,** chairman of the board and director; **William H. Flynn,** vice president and director; **Ben S. Robinson,** director; **Douglas W. Wade,** secretary-treasurer and director; and **Dr. Wendell H. Nedderman,** director. The platform, designed by William H. Flynn and Dr. Wendell H. Nedderman, will be constructed by Port Houston Iron Works, Inc., and is scheduled for completion prior to August 1, 1957. The platform is an elevating deck type using 12 48-inch diameter tubular steel column legs of 1⅛-inch wall thickness. It is 185 feet long and 87 feet wide. Its 12 legs are operated by hydraulically actuated mechanical slip type jacking mechanisms. Each jack will be designed to hoist 450 tons and retract 700 tons in pulling the legs from the ocean bottom.

All machinery except for the drawworks, substructure and derrick is located below the main deck inside the hull. The drawworks, substructure and derrick are skidded over and retracted from a 36-foot wide by 35-foot long slot by means of hydraulic powered skid jacks at each of the two skid beams. All bulk materials and liquids are stored within the hull with the liquids being carried with the 17-foot diameter longitudinal tubes outboard on each side, each of which straddles the legs. The gross weight of the platform including maximum capacities of materials and liquids is approximately 4200 tons including pile legs. The drilling rig will be diesel-electric driven with a total of 2625 horsepower provided by three engine generator sets. The drawworks will have 2000 hp available from three motors and two mud pumps will have an input capacity of 1250 hp on each. The rig is designed for drilling to 20,000 to 25,000 feet depth range and is as large and powerful as any offshore rig in the industry. When fully loaded, it has a draft of 9 feet 8 inches. Its maximum operating water depth during hurricane season is 60 feet, and in calmer weather, it can operate in 75 feet.

•

STANOLIND OIL PURCHASING COMPANY changed its name to **INDIANA OIL PURCHASING COMPANY,** effective February 1, 1957. **R. F. Pielsticker,** president, announced. The new company will continue its general office in Tulsa, and will establish a division office in Houston. This office, which will be responsible for the company's activities in East Texas and on the Texas Gulf Coast, will be under the direction of **R. W. Pitcher** as manager. Pitcher has been with Pan American Production Company for over seven years as manager of crude oil purchasing. Pitcher will be assisted by **M. S. Keffer,** who has been with Stanolind for eight years and most recently has been located in Houston as the company's crude oil buyer, Gulf Coast area. The crude oil purchasing activities formerly handled by Pan American Production Company will now be handled by Indiana Oil Purchasing Company and the Houston office will be located in the Mellie Esperson building.

•

TOKLAN OIL CORPORATION of Tulsa will have 40 percent ownership interest purchased by Houston oil man **Cecil V. Hagen** when he buys all the Toklan shares now owned or controlled by Venezuela Syndicate, Inc. It has also been announced that **A. F. Childers, Jr.,** formerly executive vice president of Toklan, has been elected president of the firm to fill the vacancy created by the resignation of **Roy B. Kelly.** Toklan Oil and Gulf Coast Leaseholds, Inc., of Houston jointly own and operate Mid-Continent properties purchased last year from National Associated Petroleum Company. These properties included, at the time of purchase, interests in 344 producing oil wells with a net production of 2200 barrels per day on 172 oil and gas leases in six states. Hagen is president of Gulf Coast Leaseholds and one of its largest stockholders. In addition to the new president, Toklan directors in a special meeting elected **C. K. Smith** of Tulsa as vice president in charge of drilling and production. He had formerly been general superintendent. **E. P. Neal,** manager of the Exploration department, was elevated to vice president by the directors. Childers spent 17 years with Gulf Oil Corporation as a petroleum geologist and valuation engineer. He was associated for several years with Cecil Hagen and Associates, a consulting firm, immediately prior to joining Toklan as executive vice president last year.

•

STANOLIND OIL AND GAS COMPANY took the name of **PAN AMERICAN PETROLEUM CORPORATION** February 1, **E. F. Bullard,** president, announced. He said the change was made for two reasons: to eliminate any possibility of confusion in the public mind between Stanolind Oil and Gas Company and other oil companies with names similar to or having a significance similar to the Stanolind name, and to give the Tulsa-based firm a name more indicative of the geographical extent of its operations. He noted that within the past 15 months, the company has extended its exploratory effort to Cuba, Jamaica and Venezuela, and that it has been active in Canada for more than nine years. "The new name will indicate our expanding interest in petroleum exploration in the Western Hemisphere," Bullard commented. He emphasized that the change is one of corporate name only. The change will not in any way affect the employment practices, operating policies, benefit programs, or any of other activities.

•

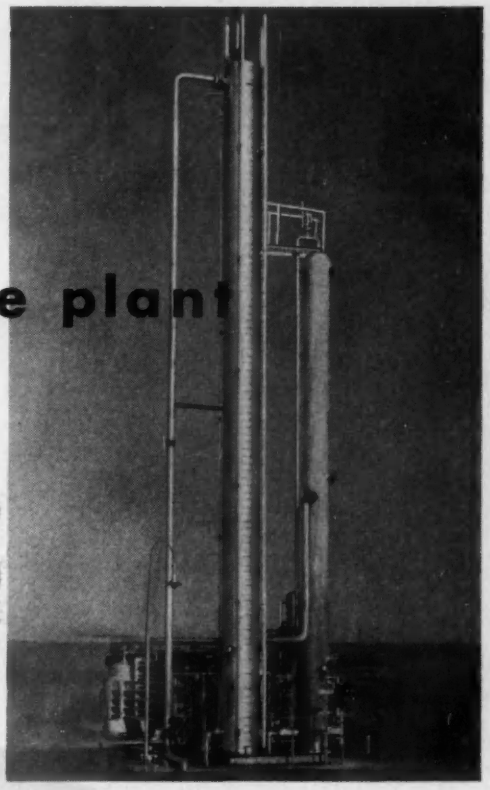
MOBILE OFFSHORE CO., a new company for contract drilling operations in the Gulf of Mexico, has been formed by a group of Houston oil operators and marine contractors. simultaneously the officers announced that their first mobile drilling unit, which will be for deeper water than any fixed-deck type unit yet constructed, will be completed next June. **Bowman Thomas,** whose Thomas & Meadows Drilling Co. will be absorbed by the new company, is president and director; **Herman Brown,** president of Brown & Root, Inc., director; **Harold Decker,** former president of Houston Oil Co. and now president of Highland Oil Co., is a director and vice president; **W. J. Goldston,** president of Goldston Oil Corp., director and vice president; **Foster Parker,** formerly treasurer of Houston Oil Co. and now with Brown & Root as controller, secretary; **Herbert J. Frensley,** secretary of Brown & Root, assistant secretary; and **L. J. O'Connor, Jr.,** vice president and treasurer of Goldston Oil Corp., treasurer. Headquarters are in the San Jacinto Building in Houston. The project is privately financed. Thomas was formerly chief petroleum engineer for Humble Oil & Refining Company, and in charge of the Marine Equipment division and the Drilling Equipment division. He was in charge of Humble's ship construction when Humble entered full scale operations in the Gulf and was assistant manager of production when he formed his own company in 1955. Ingalls Shipbuilding Co. of Pascagoula, Miss., has the contract for building the submersible, self contained drilling unit, and steel is now being delivered. A unique feature of this submersible barge is that there are no sea cocks, valves, piping or pump room in the hull, thus eliminating chance of instability while afloat resulting from accidental flooding of ballast tanks. The unit can drill as many as eight wells without moving the barge and can drill and work over wells, on existing producing platforms.

Bowman Thomas

•

PANHANDLE OIL CORPORATION stockholders approved the management's proposal to merge the corporation into **AMERICAN PETROFINA, INCORPORATED.** Under the plan each share of Panhandle common stock will be converted into 1.3 shares of American Petrofina class A common stock. With the merger, American Petrofina, the surviving company, acquires all of the oil properties and other assets of Panhandle and in addition will have substantial new funds for purposes of expansion. American Petrofina is an affiliate of **COMPAGNIE FINANCIERE BELGE DES PETROLES** (Petrofina of Belgium), an international organization engaged in the production, refining, marketing and transportation of petroleum.

portable gasoline plant



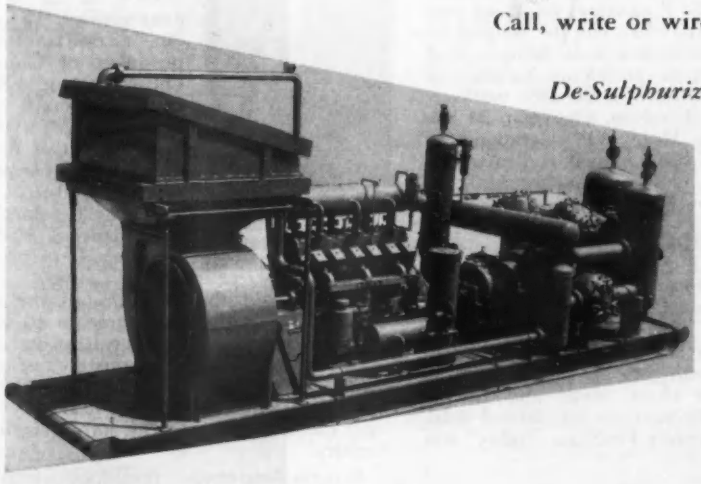
The McNamar portable gasoline plant is designed to control the hydrocarbon content of sales gas and to economically recover natural gasoline and LPG.

The plants are also designed to fractionate the distillate, if desired. The ease of moving from one location to another, the simplicity in design, and the dependable operation of this unit are factors that greatly reduce operating and maintenance costs.

The usage of the McNamar portable gasoline plant is extremely flexible. The unit can be completely operated automatically, saving time and costs.

For dependable, economical gas plant operation, you can be assured of complete satisfaction when you purchase McNamar quality equipment.

Call, write or wire McNamar for further information.



De-Sulphurization Plants • *Glycol and Solid Dessicant Units*

The McNamar Joy-Gas Compressor units are available in one, two or four cylinder models. Extremely portable, the unit can be moved on a tandem semi-trailer without disassembling.

McNAMAR BOILER & TANK CO.

BOX 868 — TULSA, OKLAHOMA CHerry 2-6291

What's Happening

AMONG INDUSTRY ASSOCIATIONS

Gaylord Is Los Angeles Nomad President

The newly elected officers for 1957 and the outgoing officers they replace are shown at a recent meeting of the Los Angeles chapter of Nomads. Left to right, they are (standing) John S. Page, assistant treasurer, 1956; Andy Anderson, assistant secretary 1957; W. B. Reinhold, assistant treasurer 1957; H. Rex Collins, Jr., treasurer 1956; John McEwen, assistant secretary 1956; Joe Schlarb, regent 1956 and 1957; John Flanagan, senior regent 1956; J. Murray Walker, deputy sergeant-at-arms 1956; (seated) Tom R. Ashe, deputy sergeant-at-arms 1957; Earl M. Daniels, sergeant-at-arms 1957; Ben A. Hilliard, treasurer 1957; Bob Gaylord, president 1957 and secretary 1956; Bill Brooks, vice president 1957 and sergeant-at-arms 1956; Tom G. Martin, secretary 1957 and vice president 1956; Harry E. Hester, regent 1957 and president 1956.

Harrison Is President Of Stripper Association

Wilbur B. Harrison, president of Apex Petroleum Corporation, Ltd., was named president of the California Stripper Well Association, organization of marginal oil well operators in California. Harrison was elected by the board of directors of the association to fill the vacancy caused by the resignation of Victor L. Norman, long time president of the group, who resigned.

Harrison's company operates in several fields in Los Angeles Basin and San Joaquin Valley. The principal offices for his operations are in Long Beach where he is a resident and long time industry leader.

Norman was presented on his resignation with a scrolled resolution of appreciation for his nine years of service as president of the oil trade group and 15 years of service as a member of the board of directors.

Petroleum Council Sets Up Emergency Tanker Committee

In response to a request from the assistant Secretary of the Interior, the chairman of the National Petroleum Council, Walter S. Hallanan, acting under the council's emergency procedure and with the approval of the Council's Agenda Committee, announced the appointment of a committee on Petroleum Tanker Requirements.

The Government has asked the Council to make a study of petroleum tanker transportation which would include the construction schedule by number and size, U. S. and world-wide, between now and 1965, without regard to registry, of all tankers either under construction, on order, or definitely planned and the extent to which ships now on order but not started may be increased in size.

The request for the study by the National Petroleum Council is the outgrowth of recent meetings of representatives of the petroleum industry with Cabinet members, the Director of the Office of Defense Mobilization and other Government officials in response to a memorandum issued by President Dwight D. Eisenhower, to Dr. Arthur S. Flemming, directing him to consider plans that will be helpful in assuring the efficiency and adequacy of the distribution of petroleum supplies in the foreseeable future in the free world.

B. Brewster Jennings, chairman of the board, Socony Mobil Oil Company in New York has been named chairman.

UT Sponsors Conference For Oil Company Editors

Editors of oil company magazines and related publications attended a conference last December at The University of Texas.

The School of Journalism and Petroleum Extension Service sponsored the second annual meeting to give the editors an opportunity to share ideas and discuss problems unique to their specialized field. "Facing Tomorrow's Problems Today" was the theme.

AAPG Elects 4 Officers By Mail Ballot Recently

New officers elected by mail ballot by the American Association of Petroleum Geologists, Pacific section are: Harvey W. Lee, president; Robert B. Kelly, vice president; William E. Kennett, treasurer and Aden W. Hughes, secretary.

Lee, administrative assistant for the Union Oil Company, has worked for the company during the past 30 years. Kelly, senior geologist, Continental Oil Company, has worked for the company 16 years. Kennett, geologist for The Superior Oil Company, has been with Superior for 17 years. Hughes, consulting geologist, has been consulting for Goudkoff and Hughes for the past five years and previously was employed for 16 years by Union.

F. R. Schmieder to Head Southern California OIC

F. R. (Dutch) Schmieder of Shell Oil Company, has been named chairman of the OIC Southern California Committee.

Schmieder is general superintendent of the Production department at Shell in Los Angeles, having spent 29 years in oil with Shell on the West Coast, starting as a roustabout at Ventura in 1927.

He previously has served as education chairman of the OIC Southern California Committee, member of the OIC State Board and chairman of the Kern County OIC Committee.

At Shell Schmieder recently has headed three western production divisions, including service as manager at Bakersfield in San Joaquin division, at Ventura in the Coastal division and at Long Beach in the Los Angeles Basin division.

New Institute to Tell Story Of Independent Oil Industry

A newly formed California Independent Oil Institute will dramatize the importance of California's independent oil industry to the economic well-being of the entire state.

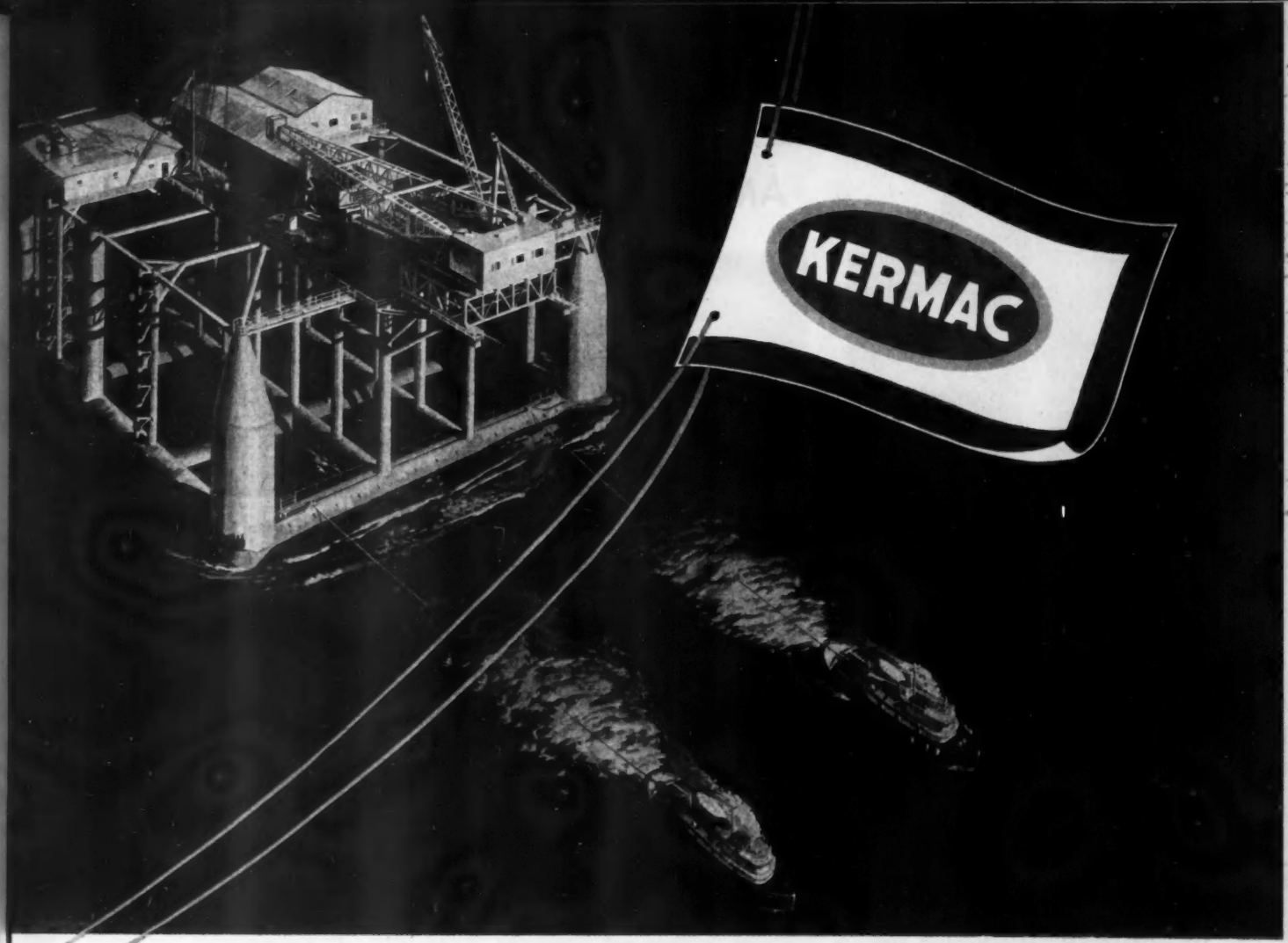
George T. Goggin

The Institute elected as its president George T. Goggin, executive vice president of Douglas Oil Company. Other officers named were Lloyd L. Aubert (president of Bankline Oil Company) as vice president and Richard K. Jamison (president of Harbor Refining Company) as secretary-treasurer.

Goggin said that the aim of the new organization is to bring home to all Californians the fact that a healthy and vigorous independent oil industry not only helps keep gasoline prices realistic through fair competition, but it is a necessary and vital factor in keeping the state's economy healthy.

Goggin, currently president of Independent Refiners' Association of California, has been associated with Douglas Oil Company since its incorporation.

The companies participating in the present educational campaign market the following brands of gasoline: Beacon, Century, Craig, Douglas, Golden Eagle, Harbor, Newhall, Norwalk, Paragon, Powerine, Sunland, Veltex and Wilshire.



KERMAC RIG 46

heads for open water...

Rig 46, in tow to its first location by powerful G & H 1700-horsepower tugs GRAMPUS and PIKE, measures 242 feet in length, 202 feet in width and is designed to operate in water depths to 70 feet. With a weight on bottom of 5000 tons, it is another new giant for the offshore oil fields.

Kermac Rig 46, newest addition to the growing fleet of offshore drilling equipment owned and operated by Kerr-McGee Oil Industries, Inc., represents a new principle in drilling barge design. Free of moving parts—no pontoons and no deck elevation equipment—this self-contained unit is the world's largest ocean-going drilling barge—tallest floating structure—and largest submarine now in operation. With a working area 100 feet above the base line, nearly as large as a city block, Rig 46 is a massive structure to move from place to place.

With more than 35 years diversified marine experience to guide them, G & H Towing Company has pioneered in offshore towing of mobile drilling platforms . . . providing dependable towing teamwork for the oil industry offshore. Equipped with one of the most modern, thoroughly inspected diesel tug boat fleets afloat, operated by fully licensed crews who know and respect the sea, G & H can dependably and economically tow anything that floats . . . anytime, anywhere.

Call the G & H office nearest you today and let us help you solve your offshore towing problems. No obligation, of course.

G and H

DAY OR NIGHT PHONE
Galveston 3-6468 or 3-6873
Houston WA 8-5406 or
MI 5-3614
Corpus Christi TU 4-8791

TOWING COMPANY INC.

FLEET OF MODERN 700 TO 1700 HP TUGBOATS FOR EVERY TOWING REQUIREMENT

HOUSTON — GALVESTON — CORPUS CHRISTI

802 U. S. National Bank Building

What's Happening

AMONG SERVICE AND SUPPLY MEN

Martin W. Smith

Bernie W. Lawson

Henry J. James

Bill G. Brewer

Marion C. Hutton

C. E. Russell

Vance E. Vorhees

Carl E. Schmitz

B. H. Stenberg

E. H. Stubenrauch

C. J. McBride

Duane Schmeeckle

Weatherford Oil Tool Company of Houston has added four sales and service engineers and an airplane pilot. New sales and service engineers in the Houston area are **Bernie W. Lawson** and **Henry J. (Bud) James.** The pilot, who will operate out of Houston, is **Martin W. Smith. Bill G. Brewer** is a new sales and service engineer in the Western division stationed at Odessa, Texas, and **Marion C. Hutton** has the same duties in the Southern division with headquarters in Alice. Lawson formerly was with the Permian Mud Service in Odessa and prior to that was associated with Stanolind Oil and Gas Company. James comes to Weatherford from Corpus Christi, Texas, where he was with the Roberts Directional Drilling Co., and Brewer formerly was with Associated Oil Field Rentals in Odessa. Hutton formerly was with the McEvoy Company and the Baker Oil Tools Company. Smith, the pilot, until recently was a charter pilot for the Casper Flying Service in Casper, Wyo.

•

C. E. Russell has been elevated from works manager to vice president in charge of manufacturing at **The J. B. Beaird Company, Inc.** The election of Russell is the first executive promotion since the merger of the Beaird Company and American Machine & Foundry Company on Dec. 26, 1956. In assuming his new position, Russell will continue to direct the production of all manufacturing divisions. His present promotion marks the third advance for Russell since he became associated with Beaird on June 29, 1953. First assigned as manager of the Machine division, Russell moved up to assistant works manager in 1954, then advanced to works manager in 1955. As vice president in charge of manufacturing, he will exercise general supervision of production at Beaird's new plant in Clinton, Iowa, scheduled to begin operations this spring, as well as the Shreveport plant with its complete production lines for the manufacture of packaged compressor plants, LP-Gas and anhydrous ammonia storage equipment, piling for offshore drilling platforms, air receivers and contract machining. Before coming to Shreveport, Russell was assistant general manager of the Turner Brass Works in Sycamore, Ill., for three years. Previously, he had held executive posts in production departments of midwestern manufacturing firms.

•

Crane Packing Co. has announced four executive promotions. **Carl E. Schmitz** has been advanced to executive vice president from his former capacity as vice president in charge of sales. **Vance E. Vorhees** was promoted to vice president in charge of sales from assistant general sales manager. **B. H. Stenberg,** formerly works manager, is now vice president in charge of manufacturing. **E. H. Stubenrauch** has been promoted to assistant general sales manager from divisional sales manager.

•

C. J. (Neil) McBride has been appointed director of research for **Tubular Lining Corporation,** applicators and compounders of plastic linings for oil field tubing. McBride will direct the activities of the Research and Development departments. Before assuming his present position, he was assistant chief chemist at Tube-Kote, Inc., and technical director at Plastic Applicators, Inc.

•

Duane Schmeeckle was appointed as **Rolo Manufacturing Company** representative for Canada. He was formerly division mechanical engineer for Shell Oil Company in Edmonton. He had been with Shell in Canada for five years. Schmeekle's firm, Petro-Automation Industries Limited, has its headquarters in Edmonton, Alberta.

•

Fairbanks, Morse & Co., Chicago manufacturers, have recently announced a number of changes in their manufacturing organization personnel. **P. R. Flood,** formerly manager of the Pomona, Calif., Works of the company, has been promoted to the position of general manager of the Beloit, Wis., Works. He succeeds **W. E. Watson** who has left Fairbanks, Morse & Co. to take an important position with another corporation. **W. P. McAnally** who has been manager of the Stuttgart, Ark., Works of the company for a number of years, has been transferred to Pomona, to manage the company's Pomona Works. **C. H. Johnson,** who has for the past several years been manufacturing superintendent of the company's Kansas City, Kansas, Works, has been promoted to general manager of the Stuttgart Works of the corporation.

•

Thirteen personnel promotions, changes and transfers have been announced by the **Houston Oil Field Material Company, Inc.** They are: **Donald R. Atkins,** directional engineer from Houston to New Iberia, La.; **Alton D. Breedlove,** from sales, Pearsall, Texas, to sales, Carrizo Springs, Texas; **A. F. Coleman,** from service, Sherman, Texas, to fishing tool supervisor, Houston. **George E. Coleman,** from Odessa to Farmington, N. M.; **Talley M. Dosier,** from fishing tool supervisor, New Iberia, La. to district manager, Morgan City, La.; **N. W. Follis,** from Houston to Liberty, Texas; **James J. Gross,** from Sherman, Texas to

IT'S BRAND NEW!

The O-C-T UNIVERSAL TUBING HEAD

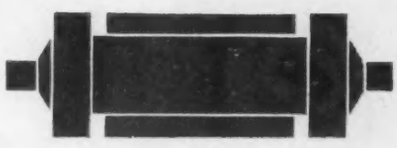
. . with 6 interchangeable dual string and single string tubing hangers!

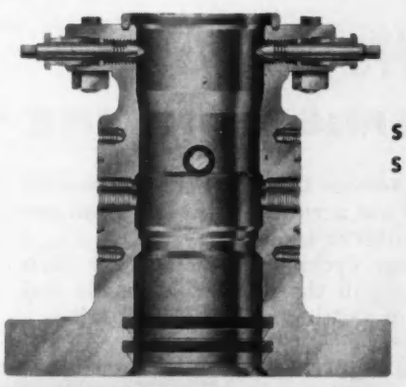
The new O-C-T universal tubing head is available with a complete range of interchangeable tubing hangers for both dual and single strings. Last minute changes in completions can be made without changing tubing heads or using special attachments. If only one producing sand is found in a proposed dual well, the well may be completed by using a single string hanger. If a second sand is found in a well originally scheduled for single completion, the well may be completed with a dual hanger instead of the single hanger originally contemplated.

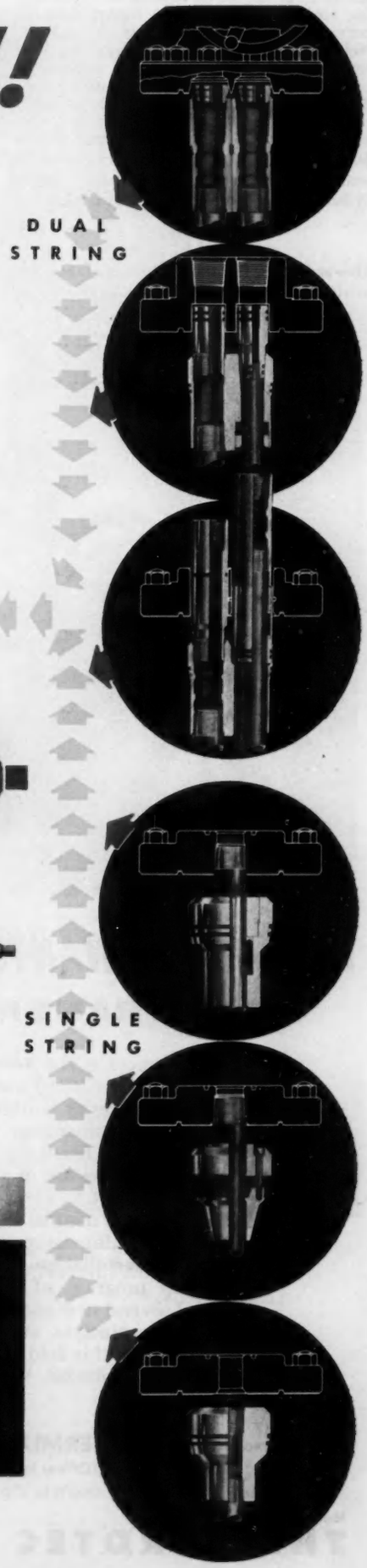
The O-C-T universal tubing head is equipped with two retractable aligning screws which are used to align the dual hanger with respect to the head itself. These aligning screws are retracted when single string hangers are used.

Safety is assured, since all hangers are run through, landed and locked in place prior to the removal of blowout preventers. Once the head has been installed, all seals can be field tested through test ports located in the flanges.

This universal head is available in 600 through 2900 series and flange sizes from 6" to 10". If an operator does not desire to remove the existing tubing head in order to dually complete a well, an adapter is available.







Any of six interchangeable hangers may be landed and locked in place through blowout preventers

All seals may be tested by a single application of pressure through a test port in the top adapter flange

O·C·T

OIL CENTER TOOL CO.

Export Representatives: South America — East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.

Kenedy, Texas. **B. C. Matthews,** from fishing tool, Casper, Wyo. to fishing tool supervisor, Louisiana and Mississippi; **J. D. Nelson,** from fishing tool supervisor, Victoria, Texas, to field service represnetative, Houston. **George M. O'Leary,** from detail draftsman to engineer trainee, Houston; **John C. O'Leary,** from detail draftsman to engineer trainee, Houston; **James E. White, Jr.,** from project engineer to senior project engineer, Houston; **Lewis Wilson,** from Houston to Harvey, La.

•

Howard A. Reid has been appointed executive assistant to the vice president in charge of sales for **Walworth Company.** He will coordinate advertising, market research, sales training, sales promotion and public relations for Walworth. He formerly directed advertising and sales promotion for American Machine & Foundry Co.

•

Lane-Wells Company announced the following location and personnel changes. **Edward C. Butts, Jr.,** has been transferred from Houma, La., to Houston as district sales engineer trainee. **Carl H. Leidecker** transferred from Bakersfield, Calif., to Pampa, Texas, as district sales engineer.

Judson D. Lowd has been appointed export manager for **National Tank Company,** Tulsa. Lowd's background includes association with Parkersburg Rig & Reel as district engineer, assistant to general manager and, more recently, manager of oil field equipment sales. Lowd will office with National Tank Company's export agent, The National Supply Company, Export division in New York City. Lowd will work with National Supply's management in sales promotion and service of exported production and processing equipment.

Judson D. Lowd

M. L. Talbert

M. L. Talbert was appointed chief engineer for **Security Engineering Division.** In his new capacity Talbert will coordinate field and in-plane engineering functions in the development and manufacture of rock bits and allied drilling equipment. He has been active in the engineering of drilling tools for the past 20 years. Formerly assistant chief engineer, he replaces **Carl Lichte** who has joined the Turbo-Drill Division of Dresser Industries. Security is one of the Dresser Industries.

•

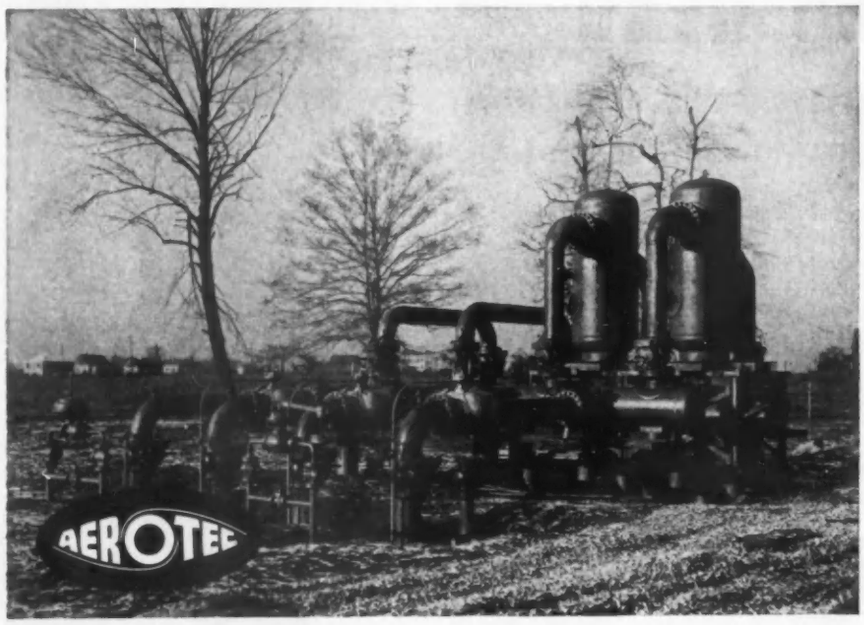
Mission Manufacturing Co. of Houston has promoted two men to district managers. **John H. Brown** is now manager of the Mid-Continent district. Included in this district are south Oklahoma, north Oklahoma, Kansas and northeast U. S. territories. **John H. Bannister** has been named manager for the West Texas district. Included in this district are New Mexico, Arizona, north Texas, West Texas and northwest Texas territories. These represent the second and third districts to be set up under Mission's expansion program. Bannister is headquartered in Midland, Texas, and Brown in Marlow, Okla.

•

A. O. Smith Corporation has elected three new officers of the company. Named as vice presidents were **U. T. Kuechle,** who has been automotive general sales manager since 1954, and **Roy A. Dingman,** who joined the company in April, 1956, as director of industrial relations. **Robert A. Rietz** was named assistant secretary. Kuechle joined A. O. Smith in 1929. He worked for a short time in the Personnel department, then went into automotive sales. Dingman was industrial relations manager of the Weyerhaeuser Timber Co., of Tacoma, Wash., from 1948 until he joined A. O. Smith. Prior to that he had been vice president in charge of industrial relations for the Commonwealth Edison Co., of Chicago. Rietz came to A. O. Smith in 1948.

•

Arch F. Campbell, manager of engine sales for **General Motors,** retired January 1 after 37 years in the oil business. He was honored by officials of General Motors and scores of oil operators at a farewell dinner recently in Tulsa.



No CONTAMINANTS in this

GAS TRANSMISSION LINE

The development of the Aerotec Dry Gas Scrubber several years ago provided the First Scrubber to assure clean gas with no carry-over of liquids or solids.

Multiple small-diameter cyclone tubes create a high centrifugal force, resulting in the removal of solids and liquids without the use of wetting agents. The result is a dry, clean product.

This principle assures high efficiency, and continuous discharge of contaminants with no pressure build-up.

Since the installation of the first Aerotec Scrubber, a continuous program of research and development has produced several new and outstanding design and applications of this principle. Our Project Engineers, with years of experience in this field, will be glad to help you in working out your problems. Why not contact them today?

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.
(Offices in 38 principal cities)
Canadian Affiliates: T. C. CHOWN, LTD., 1440 S. Catherine St. W., Montreal, Que.

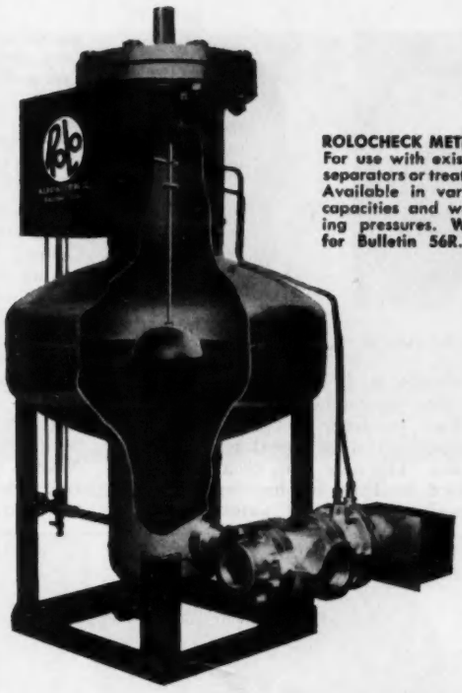
Manufacturers
THE AEROTEC CORPORATION
Greenwich, Conn.

When it comes to oil field metering . . . there's nothing better than

ROLOCHECK

equipment

ROLOCHECK Meters measure oil by alternately filling with and discharging exactly calibrated volumes of oil. Each cycle is counted on a new, rugged counter. ROLOCHECK Meters are designed for oil field use; **proven** in oil field service . . . no gadgets, no unnecessarily complicated controls to fail in unattended operations.



ROLOCHECK METERS. For use with existing separators or treaters. Available in various capacities and working pressures. Write for Bulletin 56R.

Features of ROLOCHECK Meters:

(1) **Extreme accuracy.** Upper and lower liquid levels are controlled in reduced-diameter necks.

(2) **No slippage.** The new Rolo Neutral-Position 3-Way Valve is of a special design which eliminates the possibility of both inlet and outlet ports being open at once when the valve is switching ports. **Oil cannot bypass the meter.**

(3) **Minimum maintenance.** Only internals are a float and a float guide rod. Valve has sturdy rubber-to-metal inner valves. Sand and other sediments are no problem.

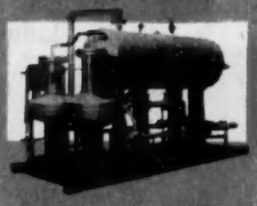
Also:

No minimum rate; will not pass free gas; new-design, rugged, foolproof counter. Equally efficient on oil or water measurement.

There's a ROLOCHECK Meter, in one of the forms shown on this page, for every application. Send in the coupon for complete information.

ROLOCHECK TWO-PHASE METERING SEPARATORS. Combine the ROLOCHECK Meter with an efficient separator, all in one vessel. Economical, space-saving. Write for Bulletin 56MS.

ROLOCHECK THREE-PHASE METERING SEPARATORS. Combine two ROLOCHECK Meters (one for oil and emulsion, one for free water) and a separator-free water knockout . . . all in one vessel. Write for Bulletin 56MS.



ROLO WELLCHECKERS. Completely piped separators with ROLOCHECK Meters and gas measurement facilities. Automatic free water knockouts, with ROLOCHECK Water Meters, optional. Available on skids or trailers. Write for Catalog 56W.

ROLO AUTOMATIC SAMPLER. The perfect sampling accessory to any ROLOCHECK Meter. For production containing free water, the addition of the Rolo Intermitter to the Rolo Sampler assures maximum sampling accuracy on even the highest water cuts. Write for Catalog 56W.

ROLO MANUFACTURING COMPANY

P. O. Box 6763 Houston 5, Texas

Midland, Corpus Christi, Kilgore, Wichita Falls, New Orleans, San Pedro, Bakersfield, Ventura, Casper, Tulsa, Mt. Vernon, Edmonton (Alta.), Venezuela: Peticon.

Export: R. S. Stokvis and Sons, Inc. • 17 Battery Pl., N.Y.C.

ROLO MANUFACTURING COMPANY

P. O. Box 6763, Houston 5, Texas

Please send me the following:

Bulletin 56R ☐ Bulletin 56MS ☐ Catalog 56W ☐

NAME_____

COMPANY_____

ADDRESS_____

Harry L. Johnson, Jr.

H. E. McGowen, Jr.

Black, Sivalls & Bryson, Inc.'s, Oil and Gas division announced the promotion of **Harry Lee Johnson, Jr.**, to the newly-created position of technical service, lease automation. The new post, created to provide added facilities for broadened industry consulation on lease automation, requires up-to-the-minute knowledge of all development work, product research and engineering on lease automation equipment. Johnson joined BS&B in 1954 after eight years' experience as a turbine engineer with General Electric Co. His engineering assignments at BS&B have been primarily in the field of lease automation.

•

Camco, Incorporated, announced the following changes: **Paul R. Mills**, president and chairman of the board; **E. K. Watters**, vice chairman of the board; **H. E. McGowen, Jr.**, executive vice president and general manager; **W. M. Edwards**, secretary and treasurer; **Pat Childs** is now general sales manager under **Sam Pearce**, vice president of sales. **H. H. Moore** has been named chief engineer. **Charles M. Nevels** has been moved from Lafayette, La., into Houston as Gulf Coast division manager, with district managers **Walter Gorth**, Houston; **J. D. Collins**, Houma, La.; **Robert Linscomb**, Lafayette; **Travis Maxwell**, Corpus Christi, Texas; and **M. G. McFall**, Shreveport, La.

•

James T. Love was promoted to assistant district manager, with headquarters in New Orleans for **United States Steel's Oil Well Supply** division. Love has served as district representative at New Orleans since April of this year. All of his 10 years service prior to that time was at Beaumont, Texas. He jointed Oilwell at Beaumont in 1946 as district engineer—refinery and pipe line equipment sales. In 1950 he became manager of the Beaumont store, and in 1955 he again was named district engineer—refinery and pipe line sales, holding that post until his transfer to New Orleans.

•

Robert H. McLemore has been elected president of **Otis Engineering Corporation**, Dallas, and its subsidiary companies. **H. C. Otis**, president and founder of the 30-year-old firm, was elected to a newly created position of chairman of the board of directors. **Herbert C. Otis, Jr.**, formerly executive vice president and secretary of the corporation, was elected first vice president and secretary. Prior to joining Otis, McLemore was vice president and general manager of the Turbodrill division of Dresser Industries. He has also been a member of the Otis board of directors for some time. There is no financial association between the two firms however, either past or future, officials said.

McLemore was executive vice president and general manager and one of the founders of Welex Jet, Inc. He began his oil industry career more than 20 years ago as a petroleum engineer for the Dallas division of Sun Oil Company. As head of Welex, he directed the development and licensing of the shaped charge or "jet" system of perforating oil well casing.

Although he remained on the board of directors, McLemore subsequently resigned from Welex to establish a consulting practice several years ago. Among his clients were Dresser, which he joined in 1955 as director of its Oil Well Services division.

•

Schlumberger Well Surveying Corporation, announced the appointment of **D. C. McCann** as president of Schlumberger's subsidiary, **Johnston Testers.** M. O. Johnston, founder of the company, and formerly president and chairman of the board, will continue to serve as board chairman. McCann Joined Schlumberger in 1935. He began as a field engineer for Schlumberger in the Gulf Coast and Shreveport areas and soon became district manager in Shreveport. In 1938, McCann was transferred to Houston and assigned to the Technical department. McCann was made a vice president of Schlumberger in 1942. He was soon transferred to operations as vice president in charge of field operations, which position he held until his new appointment as president of Johston Testers.

•

Reed Roller Bit Company has appointed four men to the position of regional representative. Promoted were **Joseph A. Kelly** of Reed's Dallas office; **James J. Young** of Tulsa; **Thomas M. Sanders** of New Iberia; and **Albert W. Short** of Houston. All of these men prior to their present appointments served as special salesmen for Reed.

Yes—thread failure on drill collars and tool joints *can* mean troublesome, costly fishing jobs—and sometimes complete loss of expensive drilling strings.

A break-out of galled and frozen joints costs money through shut down—damaged threads mean replacement of drill collars and pipe.

So—it pays to use the best.

Lubrication Engineers, Inc. are specialists in the field of quality lubrication and have developed two outstanding products that are saving dollars every day in the drilling industry.

LE #195 Drill Collar Compound is a scientific combination of metallic materials—built to withstand the high torque—pressure—and temperature of deep drilling. Forms tight leakproof seals—yet permits easy disassembly of mechanical joints.

LE #900 Tool Joint Compound is a non-hardening —easy to apply—metallic base product. Resists moisture—gives maximum assurance against galling and freezing—lengthens thread life.

AVAILABLE THROUGH MOST LOCAL SUPPLY STORES, OR WRITE, WIRE OR CALL FORT WORTH OFFICE DIRECT

LUBRICATION ENGINEERS, INC.

FORT WORTH, TEXAS

INDUSTRIAL LUBRICANTS AND OIL FIELD SPECIALTIES

For more data on advertised products, use Readers' Service Cards, last page.

Baash-Ross Sales Meeting

Baash-Ross Tool Company, Division of Joy Manufacturing Company, recently held it sales staff meeting in Houston. Under the direction of H. L. Messinger, general sales manager, all top Baash-Ross sales executives met for two days for the purpose of discussing new and better ways to improve service and products to the oil industry. The following personnel were in attendance. Seated: E. R. Lindgren, chief engineer, Houston; H. L. Messinger, Houston; Glenn D. Johnson, vice president and general manager, Houston; E. M. Gearke, regional sales manager, Houston; and Robert L. LeBus, Jr., export manager, New York City. Standing: Leo Cypher, special sales representative, Houston; Gene A. Maxwell, area engineer, Los Angeles; E. W. Carne, Jr., Caribbean sales and service representative; Gordon A. Morrison, area sales manager, Edmonton, Alberta, Canada; Donald Cook, power swivel products manager, Ventura, Calif.; R. C. Brenner, city sales, Dallas; Curtis Atkins, area sales manager, Mexico, D. F.; Thomas Ray, Jr., area sales manager, Oklahoma City; H. C. Mays, area sales manager, Odessa, Texas; Bobby G. Pritchard, city sales, Tulsa; Glenn R. Huckabay, division sales manager, New Iberia, La.; Albert E. Schoettler, general sales office supervisor, Houston; Herbert H. Klepfer, area sales manager, Los Angeles; R. W. Westerman, area sales, Olney, Ill.; and S. Gerald Fuex, manager-advertising and sales promotion.

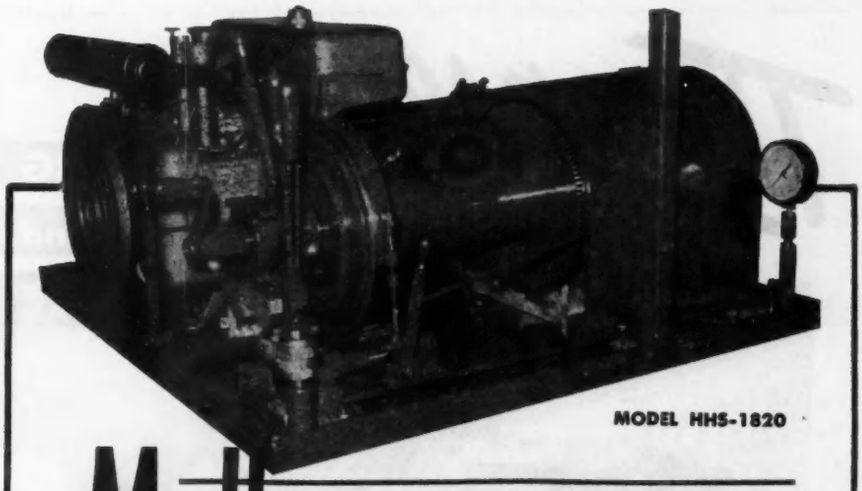
Two Texas Instruments, Inc., Subsidiaries Become Divisions

Through an organizational change, two wholly-owned subsidiaries became operating divisions, it was announced by J. E. Jonsson, president of Texas Instruments Incorporated. Houston Technical Laboratories, geophysical and industrial instrument manufacturer located in Houston, has become the Industrial Instrumentation division and Wm. I. Mann Co., precision optics manufacturer located in Monrovia, Calif., has become the Optics division.

Texas Instruments acquired Houston Technical Laboratories in 1953 and centralized in it the design, manufacture and marketing of all TI geophysical and industrial instruments. The Industrial Instrumentation division will remain in its new plant in Houston, headed by Robert W. Olson as Texas Instruments vice president in charge of the division.

Texas Instruments acquired the Wm. I. Mann Co. in 1956 and centralized in it the design, manufacture and marketing of all TI optical components. The TI Optics division will remain in California, headed by William I. Mann as division manager.

Jonsson stated that the purpose of the change was to simplify the TI corporate


MODEL HHS-1820

Mathey MEASURING LINE REELS

The Oil Industry's First Name in Reeling Equipment
"Never a Compromise in Quality"

USES:
- Bottom Hole Pressures
- Temperature Surveys
- Calipering
- Paraffin Cutting
- Sampling
- And Many Other Wire Line Jobs

Mathey Reels are available in many sizes with various drives and controls in combinations to completely meet every requirement. Choose your type of control — hydraulic or mechanical, your capacity, your line speed and pull, and your type of power—hydraulic air, electric or internal combustion engine.

Mathey's many years of experience guarantee you extra heavy duty construction, precision machining, oversize bearings and forged steel drum flanges. Mathey also engineers and manufactures specialty reels to fit your individual requirements.

Call or Write for Further Information

SEE OUR CATALOG IN THE COMPOSITE CATALOG

C. A. Mathey MACHINE WORKS, INC.
212 SO FRANKFORT TULSA, OKLA. • PHONE Diamond 3-3623

For more data on advertised products, use Readers' Service Cards, last page.

structure and to increase efficiency of the manufacturing divisions. All Texas Instruments manufacturing operations are now carried on by divisions; the two mentioned and the Apparatus and Semiconductor-Components divisions in Dallas. Other major TI operations are carried on by subsidiaries Geophysical Service Inc. and its affiliates, Engineering Supply Company and Continental Rubber Company of New York.

Chem Lab Opens Denver Office, Labs at Farmington and Sterling

Chemical and Geological Laboratories, Casper, has completed its current expansion program which was planned to provide better service in the Colorado and New Mexico areas. James E. Campbell, secretary-treasurer and sales manager, has moved to Denver to take charge of the company's newly established Denver office in the Colorado building.

Chem Lab has taken over the laboratory of Basin Core, Inc., at Sterling, Colo. The same personnel, Gordon Coe, manager, and Ed Harr and Mrs. Vena Lee Baird will continue at the Sterling laboratory. Chem Labs' special methods and equipment for core analysis have been installed in the Sterling laboratory.

Although the company's laboratory in the Four Corners' area has just been opened, Chem Lab has done a great deal of work in this section. J. G. Crawford, president, has done much of the analytical work in this area since 1930. A. G. (Pat) Jamison, manager of the Farmington laboratory, has been associated with the San Juan Basin activities for the past six years. Other personnel include Roger Artley, who has been with Chem Lab since 1952 and George Luckett. The laboratory will specialize in Chem Lab's methods of Full Diameter Core study and routine plug analysis.

J. W. Robbins

C. L. Wilson

C. D. Haehl

W. J. Slaughter

5 New Divisions Created to Push Parkersburg Products, Service

After a series of conferences to evaluate means by which better and expanded services could be offered to customers, President Bernard P. McDonough recently announced through A. G. Evans-Lombe, vice president and general sales manager, a reorganization of The Parkersburg Rig and Reel Company. The new alignment of duties and responsibilities has been effective since Jan. 1, 1957.

Under the new organization plans, five separate divisions have been created. Each division is headed by a general manager who will be responsible for all activities pertaining to products in his division.

He said that management had decided to make the move for the purpose of exerting the maximum effort toward the development, manufacturing, engineering and sales of each line of products.

Named to head the five divisions were J. W. Robbins, general manager of the Oil Field Sales division; C. D. Haehl, general manager of the Pressure Vessel division; W. J. Slaughter, general manager of the Pumping Unit division; J. Q. Callaway, manager of the Special Products division; and C. L. Wilson general manager of the Metal Building division.

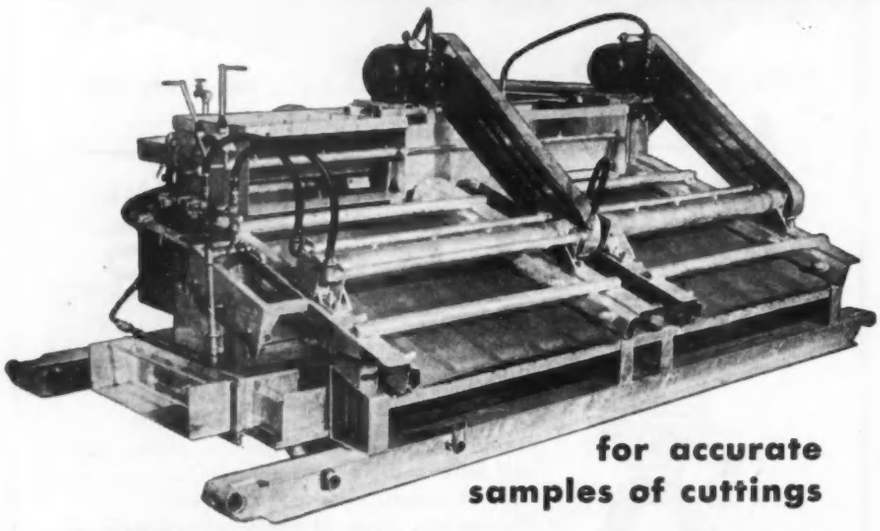
General sales offices will continue to be in Fort Worth as will headquarters for the Oil Field Sales division and Special Products division. Division offices for metal buildings, pressure vessels and pumping units will be at Parkersburg, Houston and Tulsa, respectively.

Slaughter also announced appointment of three regional sales managers for the Pumping Unit division: C. M. Ferguson was named sales manager of the Northern region with headquarters at Tulsa, G. W. Hendricks was named sales manager of the Southern region with offices at Dallas, while J. L. Norris moves to Calgary as sales manager of the Canadian region.

Haehl has appointed W. H. Land sales

Thompson

DOUBLE VIBRATING SHALE SHAKER...and SAMPLE MACHINE



for accurate samples of cuttings

The THOMPSON SHALE SHAKER SAMPLE MACHINE offers the operator and geologist one of the best methods available for obtaining accurate foot-by-foot samples of well cuttings.

This THOMPSON DOUBLE VIBRATING SHALE SHAKER and SAMPLE MACHINE is specially engineered for off-shore barges or islands, deep wells, or wells using big volume and high pressure mud pumps. It is available either plain or galvanized, which makes it rust and deterioration-proof on off-shore or coastal duty.

THOMPSON Shakers are famous for their highly efficient service at any depth or flow and for their economical first cost.

Make sure THOMPSON'S on the job for accurate samples and clean mud.

SOLD ONLY THROUGH SUPPLY STORES

Thompson TOOL CO. IOWA PARK TEXAS

EVERYWHERE IN THE OIL FIELDS

Remember when you're in a hurry to order equipment or services, look first in COMPOSITE CATALOG. Here's what you'll find to make your job easier:

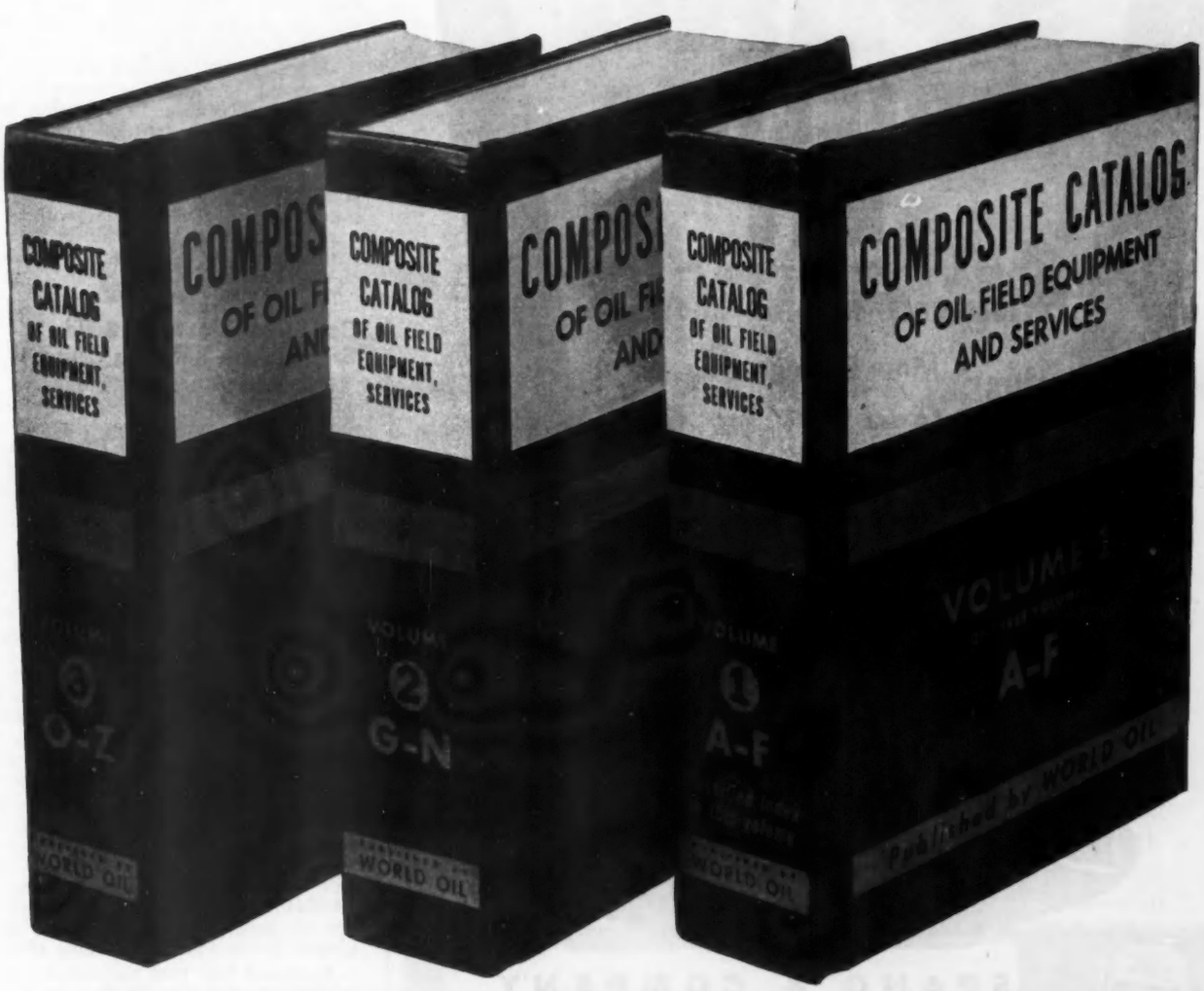
• Information on more than 3,000 products and services, indexed and cross indexed, by item and by company.

• Useful facts on weights, dimensions, specifications, applications, service, prices, etc.

• Name, address and phone number of the nearest supplier or dealer handling the equipment you want.

• Complete or condensed catalogs of more than 500 manufacturers and service companies, conveniently bound into three volumes with more than 5,000 pages of total information.

The COMPOSITE CATALOG is the ready, convenient source for equipment-service information. More than 30,000 oil men refer to it constantly. It's everywhere in the oil fields.



Gulf Publishing Company

P. O. Box 2608 **3301 Buffalo Drive** **Houston 1, Texas**

For more data on advertised products, use Readers' Service Cards, last page.

manager for the Pressure Vessel division, with headquarters in Houston. Two regional sales managers named included Ralph M. Roberts, Gulf Coast region and J. D. Connor, West Texas-New Mexico region.

Robbins also announced regional sales managers for the Oil Field Sales division. Named were L. R. Latimer, Parkersburg, sales manager of the Eastern region; J. M. Baldridge, Houston, sales manager of the Gulf Coast region; M. L. McLafferty, Tulsa, sales manager of the Northern region; B. D. McClelland, Odessa, sales manager of the West Texas-New Mexico region; W. L. Spawr, Los Angeles, sales manager of the Pacific region, and W. H. Fitzer who will continue as export manager at New York.

Grouped in the Oil Field Sales division under Robbins are lease storage tanks, stairways, walkways, loading racks, Hydromatic brakes, derricks and substructures. The division is also responsible for warehousing and providing field services common to all divisions.

Wilson appointed K. L. Rauth, Atlanta, Ga., A. P. Kilborn, Dallas, and E. B. Wilkinson, Chicago, as regional sales managers. L. H. Ostrye was named assistant to the general manager of the Metal Building division. Other regional sales managers will be appointed in the near future.

Callaway's Special Products division will include grain tanks and related products sold outside the oil industry.

United Pipe and Tube Plant To Manufacture Plastic Pipe

The United Pipe and Tube Company, a new corporation, has recently opened its plant in Lubbock. This company will produce plastic pipe for oil and gas pipe lines. Petroleum industry applications for plastic pipe include uses such as flow lines to prevent paraffin deposition, salt water disposal systems, casing head gas gathering systems, gas distribution lines and fresh water supply lines.

The management of United Pipe and Tube Company has had wide experience with other companies in the plastics industry. The president, Walter S. Prendergast, was formerly vice president and general manager of a large eastern plastics concern. A research chemist by training, Prendergast will personally direct production and research, as well as provide overall management for the company.

Rom Rhome, vice president, was for several years associated with the United States Steel Corporation, and more recently has been southwestern sales manager of a manufacturer of plastic pipe. Rhome's duties will include both sales and financial management.

W. F. Rippetoe, vice president, has had wide experience in the sale and installation of plastic pipe. Rippetoe will be in general charge of United's subsidiary, the High Plains Irrigation Supply Company.

"After considerable study, Lubbock was selected as the plant location," said Prendergast," because of its situation between the sour crude region of the Permian Basin, which is the largest potential market, and the area of shallow production in Kansas and Oklahoma.

Capital for the United Pipe and Tube Company was supplied entirely by Texas investors, according to Rhome. Several prominent independent oil operators are among the stockholders of the company.

The initial battery of equipment will include four pipe extrusion machines. Pipe sizes as large as 12 inches will be produced. Long range plans call for the plastic coating of steel pipe and the production of steel line pipe.

Caterpillar Tractor to Build Engine Plant, Research Center

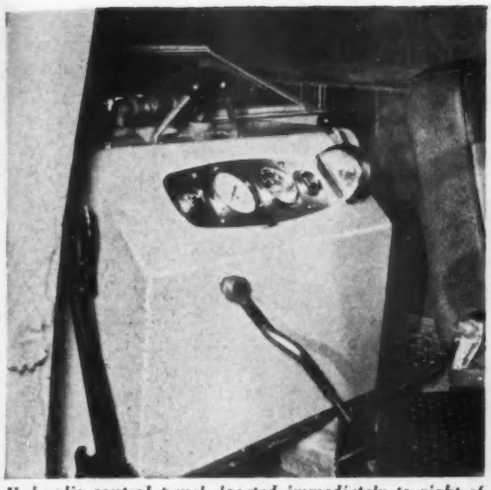
Plans to build a 500,000 square foot industrial engine plant were announced today by H. S. Eberhard, president of Caterpillar Tractor Co. The Peoria firm also announced its intention to construct a multi-building research center and a general offices building. All three facilities will be located on a 1100-acre site 12 miles north of downtown Peoria.

Site preparation for the industrial engine plant is scheduled to begin within the next few months and construction dates for the research center and general offices building will be established after planning and necessary engineering work have been completed. Operations will begin during 1958 and 1959 in the new area.

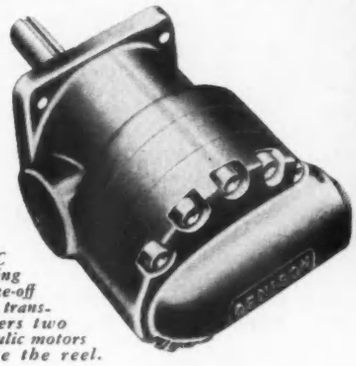
Construction of these facilities will be an important part of the company's overall building program—the total cost of which is estimated in excess of $200 million for the next three years. It is expected that approximately 3500 people will be employed in the new area when all facilities are completed. Of this number of people, about 1200 will be employed in the industrial engine plant.

Eberhard said that the expansion plans reaffirm a theme established by Caterpillar that the company has one goal: "To concentrate the capabilities, resources and experience of our people and of the worldwide Caterpillar dealer organization on the design, manufacture, distribution and service of job-tested heavy equipment."

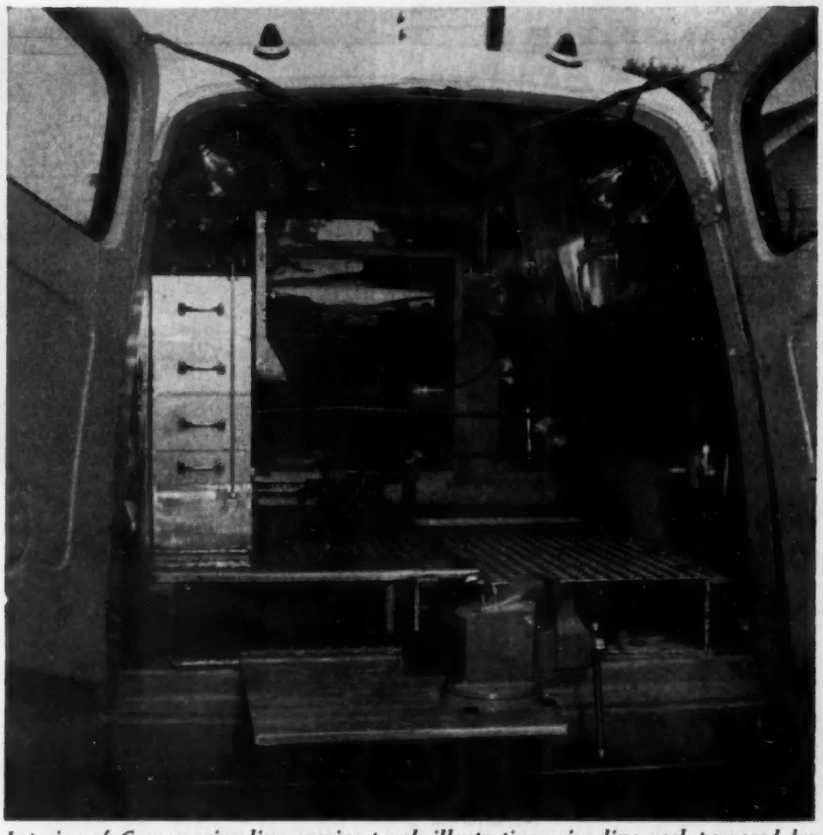
Nothing drills like a
SPANG
DRILLING BIT
Performance Records show...
● More Footage
● Lower Costs
● Fewer Failures
It doesn't take drillers long to recognize a good thing. Look around you at the record breaking number of Spang Bits being used... convinced? ... then go SPANG TODAY!
ENTIRE BIT DIE FORGED
COMPLETELY HEAT TREATED
SEMI-DRESSED ENDS
For Cable Tool data and catalog see your Spang dealer or write to:
The HIGHER STANDARD
SPANG & COMPANY
DEPT. O-6 BUTLER, PENNSYLVANIA
For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Prospect Drilling and Shot Blast Holes.



Hydraulic control panel, located immediately to right of driver's seat, permits pinpoint accuracy in controlling the wire line reel.



Denison TMC pump, operating on a power take-off from the truck transmission, powers two Denison hydraulic motors which operate the reel.



Interior of Camco wire line service truck illustrating wire line reel powered by Denison hydraulic equipment.

Camco Makes Jarring News

...hydraulically-powered service unit affords infinitely variable line speed

WITH THEIR truck-mounted, hydraulically-powered wire line unit, Camco, Inc., of Houston, Texas, has developed a means to speed and simplify oil well servicing.

Designed for removing production tools from a permanent-type well, it is easily adapted to perform surveys which determine a well's characteristics.

A Denison hydraulic pump, and two Denison hydraulic motors operate the 15,000 foot wire line reel. Seated at the control panel, the operator has infinitely variable line speed and can brake hydraulically going in or out of the hole.

The hydraulic control system makes it possible to reverse motors instantaneously while running at top speed, and permits "jar down" with a degree of controlled severity never before possible.

Hydraulic power is transmitted and applied without gears, transmission or other mechanical equipment, permitting accurate control. Better operation, savings in weight, and virtual elimination of maintenance are the benefits.

Let a Denison engineer show you how hydraulic power can improve your oil-field operations. Write to: Denison Engineering Division, American Brake Shoe Company, 1248 Dublin Road, Columbus 16, Ohio. Branch Offices at: 2501 Bartlett St., Houston 6, Texas, 4714 E. 22 Place, Tulsa, Oklahoma.

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

DENISON HydrOILics

DARCOVAS...

the perfect type and fit for every pumping job!

DARCOVA valve cups and seating rings are available at your supply store to give you unequalled pumping efficiency and economy.

Made in a complete range of types and precision sizes, they also offer you Darcova's unique *texture engineering* that multiplies cup life and minimizes slippage. There's nothing to compare with Darcova performance.

Send for Bulletin No. 5502 and be sure to specify DARCOVA at your supply store.

DARLING VALVE & MANUFACTURING COMPANY

DARCOVA ®

THE ORIGINAL COMPOSITION CUP

WILLIAMSPORT 28, PA.

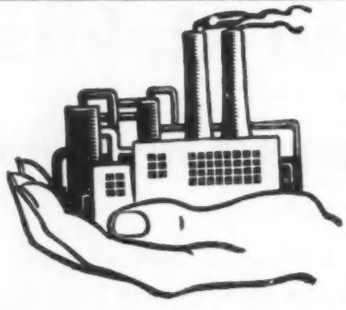
Dr. G. Herbert True (left) of Notre Dame discusses creative sales work with (left to right) Davis D. Bovaird, W. J. Bovaird, R. E. Batchelor, Roscoe G. Ayers, T. H. Trower and R. M. McMahan.

Bovaird Annual Sales Meeting Held in Tulsa Last February

The Bovaird Supply Company's annual sales meeting was held in Tulsa February 6, 7 and 8 with 80 people who represent the company in six states in attendance. Top officials of the company participated with department heads, store managers, city and field salesmen and others.

Principal speaker was Dr. G. Herbert True, marketing professor of Notre Dame University, and son-in-law of R. M. McMahan, secretary of the company. Roscoe G. Ayers, vice president and general manager, presided. Speakers on the three-day program included Davis D. Bovaird, president of the company; W. J. Bovaird, manager of stores; T. H. Trower, treasurer; R. M. McMahan, secretary; R. E. Batchelor, F. J. Robbins, C. F. Hamm, T. C. McCuistion, M. B. Park, G. E. Ferguson and D. L. Dufford.

The first day's program was confined to conferences at the home office between field personnel, management and department heads.

You Can't  **Hold Your Plant in Your Hand**

But—the Can You Hold in Your Hand Can Remove and Prevent Boiler Scale.

•

For ALL Radiator Cooling Systems — Stationary or Mobile

Remove and Prevent Rust and Scale with

SAND-BANUM SPECIAL

In Handy Tablets

•

Stocked by Leading Supply Houses

GULF COAST DISTRICT REPRESENTATIVES

Western Sand-Banum Co., 1717 Chenevert St., Houston

AMERICAN SAND-BANUM CO.

ESTABLISHED 1926

MEADOW BROOK NATIONAL BANK BUILDING

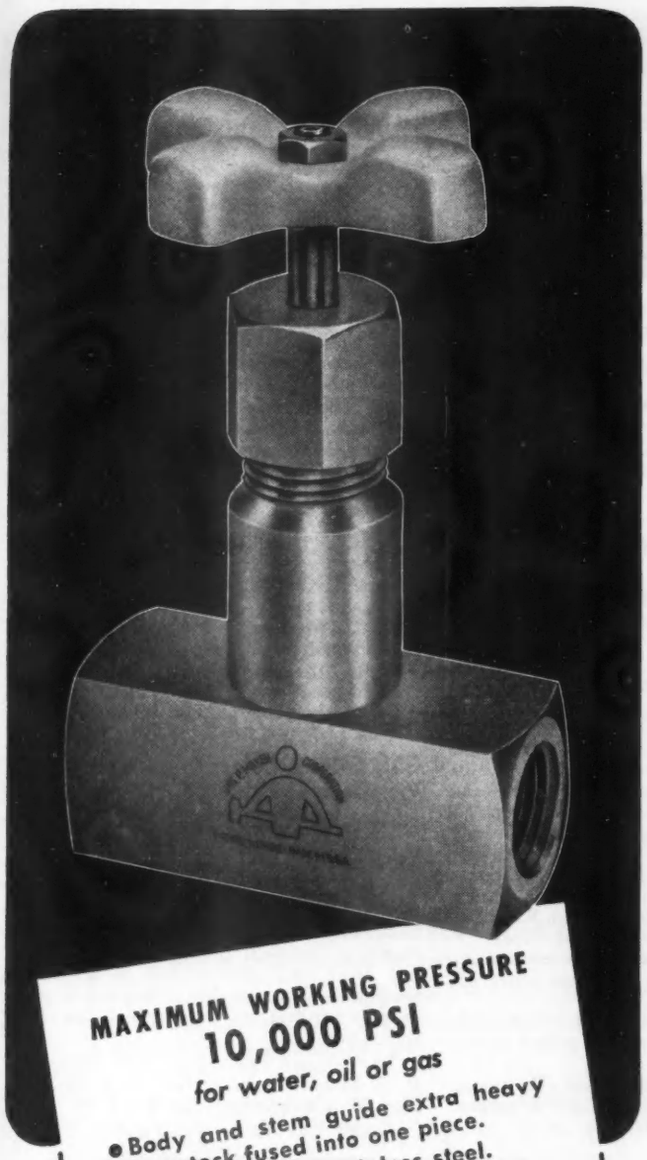
FREEPORT, NEW YORK

SAND BANUM

SAND-BANUM

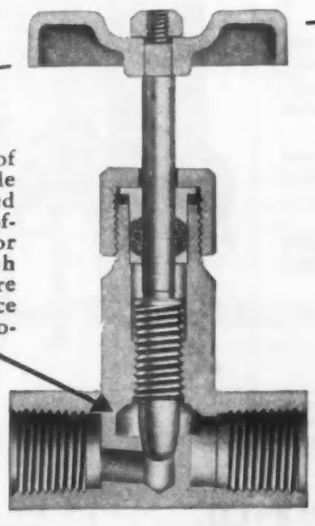
Pure Colloidal Concentrate

OUNCES ONLY ONCE A WEEK



MAXIMUM WORKING PRESSURE
10,000 PSI
for water, oil or gas

- Body and stem guide extra heavy bar stock fused into one piece.
- Valve stem 416 stainless steel.
- Packing special one-piece "Marpak" moulded ring.
- Bodies marked in accordance with MSS regulations.



ONE PIECE

The stem guides of conventional needle valves are screwed into bodies—this often causes leakage or blow-outs. Marsh Needle Valves are fused into one-piece by exclusive "Conoweld" process.

The Ultimate in Needle Valves

Here is one of the crowning achievements of Marsh research, design, and manufacturing skill. It is the first needle throttling and shutoff valve to combine *all* of the qualities called for today in this highly critical and ever broadening field.

It is a valve that has strength and safety to spare . . . rated for pressures up to 10,000 psi—equally efficient in the lower ranges. A product of Marsh instrument-making and valve manufacturing experience, it combines instrument-like precision with the ruggedness that distinguishes all Marsh valve specialties.

The illustrations tell the story of new thinking; new standards. Body and stem-guide are machined from extra-heavy carbon steel bar stock. Still greater strength and rigidity are achieved by fusing the stem-guide into the body. The complete fusion of guide and body is accomplished by the exclusive Marsh "Conoweld" process.

There are two big advantages to this one-piece construction: (1) It eliminates the danger of unscrewing the valve from the body when opening—a frequent cause of leakage, even dangerous blow-outs (2) It permits perfect line-up of threads and seat. As a result, Marsh valves are easier to operate even at high pressures.

The precision-machined stem is 416 stainless steel. Stem threads are fine pitch for extra strength and fine, controlled regulation. Notable advancements are special "Marpak" one-piece, non-binding longer-lasting packing; deep thread chambers, keeping inlet and outlet piping away from ports and contributing excellent flow characteristics. Entire packing nut and packing gland are electro-zinc plated, preventing corrosion and giving the valve a handsome, plated exterior. The rugged malleable handle is finished in heavy baked enamel.

The new needle valve line includes globe and angle patterns with double female connections in sizes ⅛", ¼", ⅜", ½", ¾" and 1". Also globe and angle valves with male inlet and female outlet in sizes ¼" and ½". *Complete stock carried at our Skokie, Illinois factory and also at our branch plant in Houston, Texas,*

Write today for catalog giving complete details.

MARSH INSTRUMENT CO. *Sales Affiliate of Jas. P. Marsh Corporation*
Dept. K, Skokie, Ill. • Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta • Houston Branch Plant: 1121 Rothwell St., Sect. 15, Houston, Texas

MARSH

"THE STANDARD OF ACCURACY"

MERCOID®

WEATHER RESISTANT CONTROLS

VISIBLE

CALIBRATED DIAL
ON-OFF SWITCH POSITION
OPERATING POINT INDICATORS

for pressure or temperature

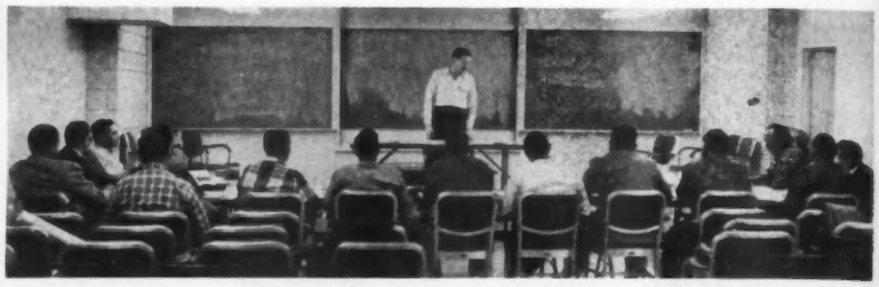
HERMETICALLY SEALED CONTACT
ZINC PLATED STEEL CASE
OUTSIDE ADJUSTMENTS

FOR OUTDOOR SERVICE
OR OTHER APPLICATIONS
(NEMA 1A, 2, 3, 4)

Drip Tight
Semi-Dust Tight
Weather Resistant
(Weather Proof)
(Splash Proof)
(Sleet Proof)
(Moisture Resistant)
(Rain Tight)
Weather Tight
(Hose Test)

Write for catalog No. 857W which also lists general purpose controls (NEMA 1) and explosion proof controls (NEMA 7, 9, 9A).

THE MERCOID CORPORATION
4201 Belmont Ave., Chicago 41, Ill.



"Never Too Old to Learn"

Francis Harris is instructing a class in acid and acidizing services for Halliburton Oil Well Cementing Co. technical school students. This is a picture of the first class of the Chemical Services School held in the new conference room at the Technical Center. Members of the class are R. I. Emery, John R. Land, C. R. Curry, C. H. Meredith, Sherman Barber, Dan Stone, L. A. Carrington, S. C. Hall, G. H. Christian, K. W. Kretzinger, Gordon Bone, Frank B. Green, Homer Pitts, S. B. Hinkle, R. F. Estes and Fredrico Chow.

Case-American Tractor Merger Completed; Rojtman Is Manager

Final consolidation of American Tractor Corporation into J. I. Case Co. was completed Jan. 10, 1957. The following day at a board meeting John T. Brown, chairman of the Case board, announced the election of Marc B. Rojtman, former president of American Tractor, to the newly created position of executive vice president and general manager of J. I. Case. Rojtman will have authority over and responsibility for the overall operation of the newly merged company. In addition, he has been elected to the board of directors and will serve on the Executive committee. Two other members of the former American Tractor board, Mentor Kraus of Fort Wayne, Ind., and Edward Elliott of New York City, have also been elected to the Case board, which now comprises 15 members.

In his initial statement, Rojtman outlined some of the major Case policy moves for 1957.

"First and foremost," said Rojtman, "will come an aggressive sales program. Sales will take the No. 1 order of importance, and we will not rest until sales volume has filled all seven existing Case plants to maximum capacity." Rojtman estimated that present Case plant production capacity now exceeds $300,000,000, whereas the combined volume of the merged companies represented only approximately $100,000,000 in 1956.

Gulf Oiltool Company Formed; Will Market Tubing Tool Joint

Gulf Oiltool Company was formed as of January 1. It is temporarily located at 1714 Ennis Street, Houston. The company is owned by D. M. Best.

Gulf Oiltool has acquired full patent ownership and manufacturing and sales rights to the Gulf tubing tool joint which has been sold throughout domestic and foreign fields since 1947. It further plans to develop and market other types of oil well tools.

The export agent for Gulf Oiltool is R. S. Stokvis & Sons, Inc., with offices in New York City.

THE WESTERN CHEMICAL FEEDER

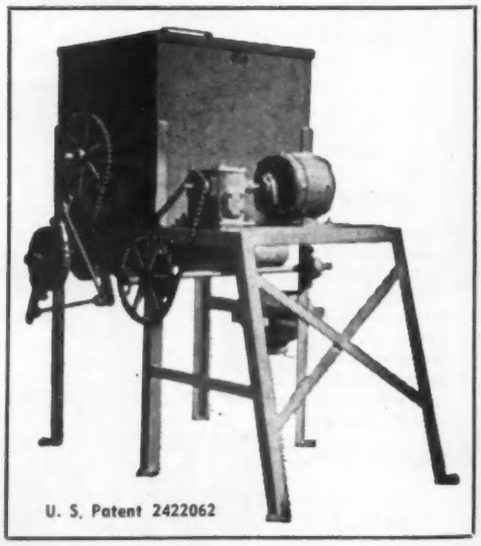
the dependable, economical water treater

CHECK THESE FEATURES:

- **Used in Oil Well Water Flooding, Municipal Water Treating Plants, Canneries, etc.**
- **Can be driven by water entering plant for treatment.**
- **Maintains pre-set water-chemical ratio through a wide rate-of-flow range.**
- **Adjustable two ways, to feed from a few pounds to several hundred pounds of chemicals per day.**
- **Also can be equipped with electric motor, or gas engine drive.**
- **Made to your specifications in various sizes.**
- **In use the world over.**

Whatever your water treating problems may be, investigate the Western Feeder. Write for literature and prices.

For complete description see Page 2777 of the Composite Catalog.



U. S. Patent 2422062

Manufactured By

KEYSTONE SUPPLY CO.

312 E. Cherokee St. Phone LD-10
NOWATA, OKLA.

HELP WANTED

SIE

OFFERS OUTSTANDING CAREER OPPORTUNITIES FOR ENGINEERING PERSONNEL

Electrical Engineers — **Mechanical Engineers**
Electronic Engineers — **Designers**
Electrical and Mechanical Draftsmen

SIE is an "engineer's company" due to the nature of its products and its wide range of diversified research and development projects. Engineers and draftsmen joining SIE now, will have an opportunity to grow with the present expansion program and to prepare for supervisory and administrative positions.

Qualified applicants will be offered attractive salaries, as well as a full range of company benefits. For further information contact:

E. G. SCHRIEVER, *Personnel Manager*

SOUTHWESTERN INDUSTRIAL ELECTRONICS COMPANY

2381 Post Oak Road — **Houston, Texas**

PROFIT FROM READING.... Here is information on books of **Practical Job-value** interest for men concerned with **Drilling and Production**

The knowledge gained through years of work and study by outstanding men in the field of exploration, drilling and production has been recorded for your reference and practical application.

- ***Composition and Properties of Oil Well Drilling Fluids***
  By WALTER F. ROGERS
  price $10.00
- ***Practical Petroleum Engineer's Handbook***
  By ZABA & DOHERTY
  price $11.00
- ***Rotary Drilling Handbook***
  By J. E. BRANTLEY
  price $10.00
- ***Acidizing Handbook***
  By BENSON M. KINGSTON
  price . . . . $ 3.50
- ***Basic Oil Geology***
  By W. W. PORTER III
  price $4.00
- ***Practical Accounting for Oil Producers***
  By ROBERT M. PITCHER
  price $9.50
- ***Petroleum Dictionary***
  By HOLLIS P. PORTER (Deceased)
  price $6.00
- ***Oil Property Valuation***
  By PAUL PAINE — price $5.50

BOOK DEPARTMENT

In ordering please make certain that your complete mailing address is included. Designate desired books by title and author. Attach your check or Money Order and shipment will be made promptly via prepaid Parcel Post.

Send for your FREE copy of the NEW PETROLEUM Books Catalog which describes the nature and contents of these and many other books pertaining to the Petroleum Industry.

THE GULF PUBLISHING COMPANY

P. O. Box 2608, Houston 1, Texas

WORLD OIL Classified Ads

Don't Cost . . . . They Pay

GSI Forms New Department; Names Anderson Manager

Russell W. Anderson has been named manager of the newly-formed Industrial Engineering department of Geophysical Service Inc. His duties will include cost estimating, cost analysis and budget control.

Russell W. Anderson

In addition, Anderson's department will have responsibility for coordinating policies and procedures for GSI's worldwide organization. The Industrial Engineering department will also direct administration of a work simplification program to be applied to field operations of GSI's geophysical exploration field parties.

Anderson joined GSI in 1948 as computer on a seismograph field party in West Texas. In 1951, he was assigned to the Dallas office as a cost analyst and was appointed cost control supervisor in 1953.

•

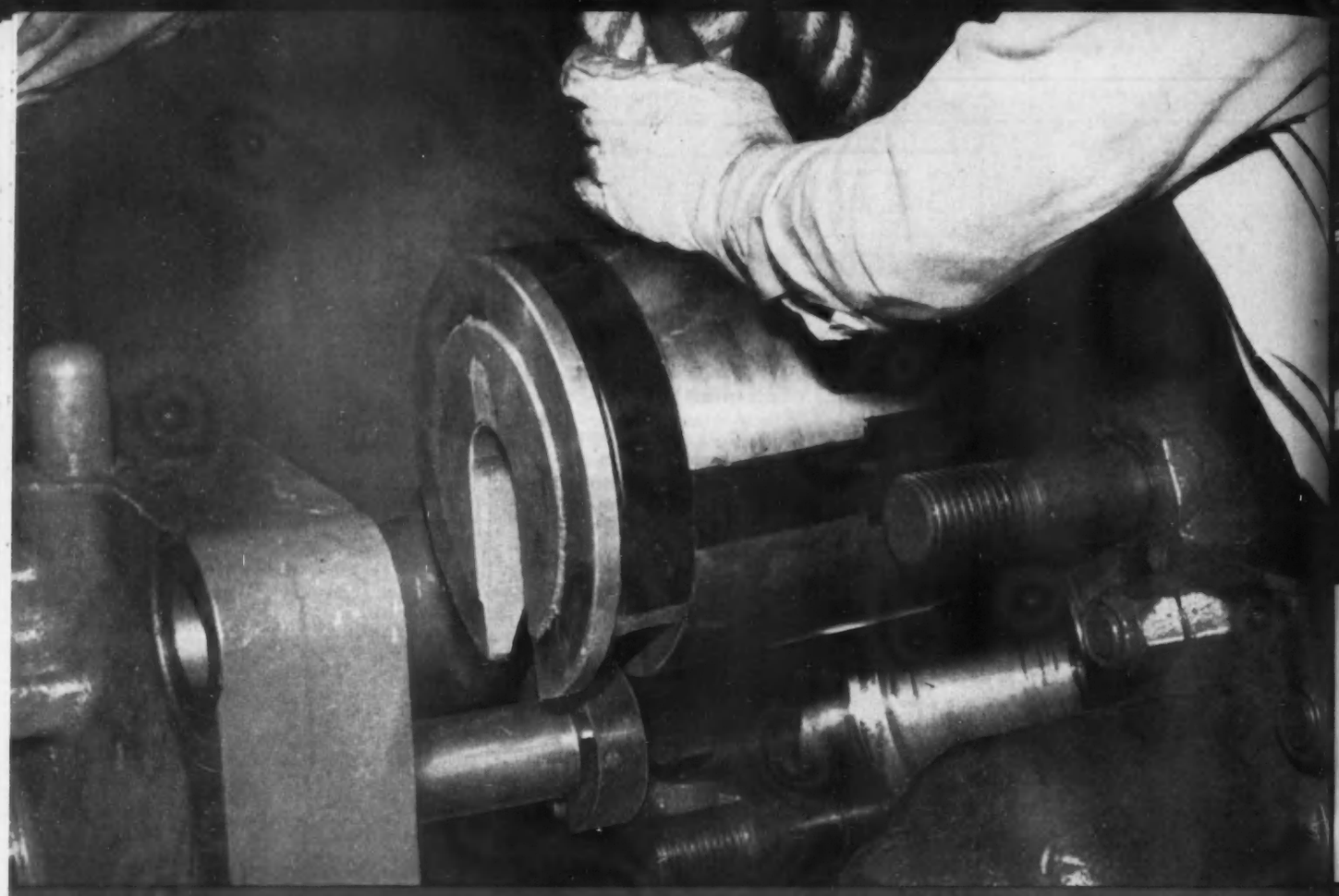
Robert Urquhart who has been general superintendent of **National Tube Co.'s** Lorain works, was transferred to the division's Pittsburgh office as an executive assistant to the vice president-operations. A veteran of 43 years in the steel industry, Urquhart joined United States Steel Corporation at the Homestead district works of the then Carnegie-Illinois Steel Corp. in 1914. He served in various capacities there eventually becoming assistant general superintendent of that works until his appointment in February of 1948 as general superintendent of National Tube's Lorain works.

How to Get Your 1956 Editorial Index

A complete editorial index covering all issues of WORLD OIL published during 1956 has been compiled and bound separately in convenient pamphlet form. It will be sent free to all subscribers requesting copies.

To get your copy, address orders to the Librarian, Gulf Publishing Company, Post Office Box 2608, Houston 1, Texas. Or if you prefer, you can use the convenient Readers' Service Blue Postcard on the last page of this issue. Just check the square indicated. Fill in your name and address. Drop the postage-paid card in the mail and the index will be sent you.

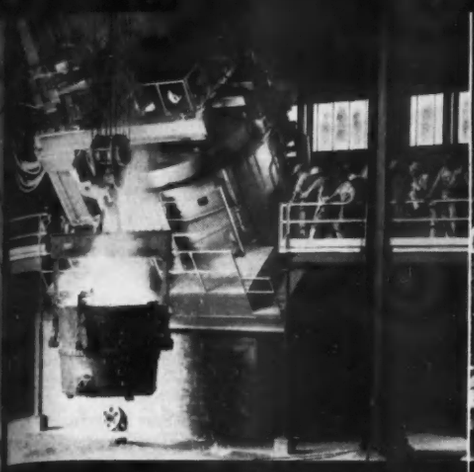
Act now. The supply is limited.



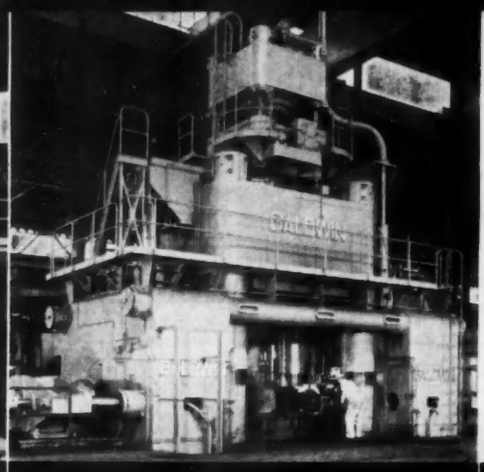
You are drilling an oil well

You are a vital link in a world necessity. In your drilling equipment, smooth efficiency means everything — the difference between success and failure. Take blowout preventers for instance — your rig investment, valuable reserves and the safety of your operating personnel often depend on this equipment, that's why you want the best. Tough, efficient Cameron preventers have been proved the best in every oil producing area of the world for over 35 years.

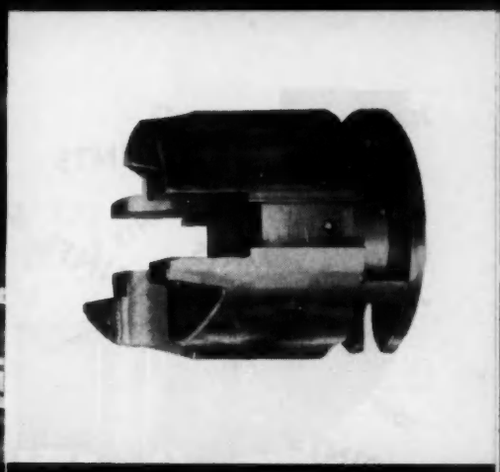
Ram design in any preventer is critical because this is the "business end" — the full force of destructive well pressures must be positively sealed off by the preventer rams. The facing page shows why the Cameron "QRC" Rams are so efficient.



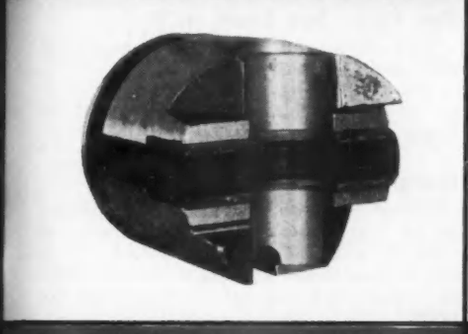
1. High quality alloy steel is produced in the Cameron melt shop under strict control.



2. Billets from this steel are forged into rams on the multi-million dollar Cameron-designed presses.

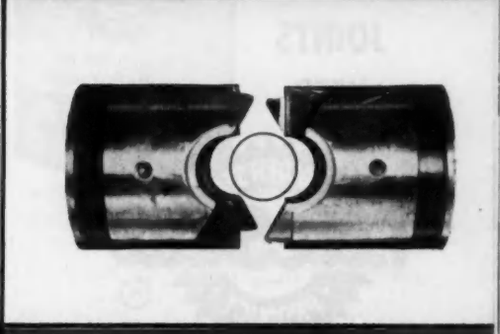


3. After machining and flame-hardening, the ram looks like this.

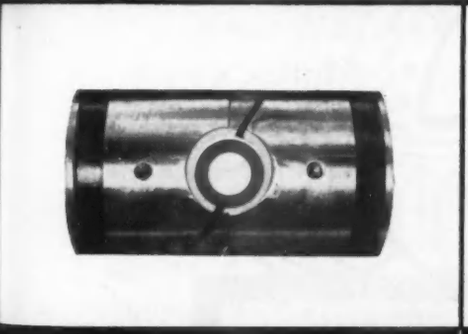


4. The complex frontal surfaces vary in different rams according to pipe size.

5. Steel reinforced "ORC" ram packing element. A big volume of Hycar oil and abrasion resistant rubber stops extreme well pressures.



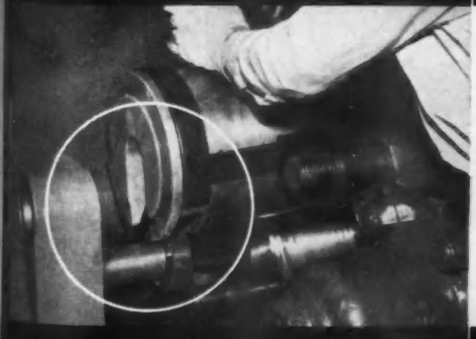
6. Wing guides automatically center pipe as rams are closed.



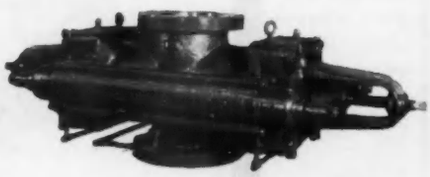
7. This view shows the rams closed without pipe in the hole. Note the red area indicating the big reserve of Hycar which is fed automatically to the pipe surface.

8. The rear seal ring traps well pressure, energizing the ram to maintain a constant seal.

9. In the Cameron Quick Ram Change there is no lifting, sliding or juggling of rams by hand on slippery cellar surfaces. Rams are safely lifted by catline — changed in minutes.



10. Preventers must open against extreme pressure. Consider this engagement between ram and ram connecting rod. Again the design is tough — tough enough to retract under any condition.



Cameron

IRON WORKS, Inc.

P. O. Box 1212, Houston, Texas

In England: Cameron Iron Works Ltd., Time & Life Bldg., New Bond Street, London W. 1 England

REMEMBER the time for prevention is before disaster threatens. Every part of a Cameron preventer is designed to do its important work fast and efficiently, safely and profitably. Take no chances — take Cameron, every time.

MILLIONS OF JOINTS NEED

A SOLDER SEAL TRADE TiteSeal MARK PRODUCT ®

Heat-proof, vibration-proof, non-solvent, non-shrinking, non-crumbling, non-cracking . . . for every gasketing and sealing requirement. Makes all assemblies leak-proof and pressure-tight. Withstands heat or cold, high pressures, oils, gases. Prevents rust, corrosion, and seizure of joints.

LIQUID WRENCH

Loosens Rusted Bolts, Nuts, Parts

A powerful blend of quick-acting, super-penetrating solvents. Frees parts frozen by rust, corrosion, scale, paint, varnish, carbon or gum.

Ask Your Supplier...or write us

RADIATOR SPECIALTY CO.

Dept. 1

CHARLOTTE, NORTH CAROLINA

2161

SQUEAKS from the BULLWHEEL

WORLD OIL

"So you see, gasoline goes through a lot of processing before it's put into your car."

"If you drink . . ."

The biggest problems for traffic-planners, it says here, are urban, suburban and bourbon drivers.

Tricked Again!

Two opposing political candidates were arguing. "There are hundreds of ways to make money," one declared, "but only one honest way."

"And what's that?" the other asked.

"Ah-ha!" the first answered. "I thought you wouldn't know."

Negative Lesson

Just about the time you teach your kids you can't put more in a container than it can hold, along comes some woman in slacks.

The Way You Look at It

Phil—"how did George go through his rich uncle's inheritance so fast?"

Bill—"Well, he spent a good bit of it on wine, women and song. The rest he squandered."

Naturally!

"Stop! Stop! shouted the alert husband as his wife, who was driving, started to cross the railroad tracks. Deaf to his cries, the woman drove on—right into the path of a train that had just come around the bend.

Husband and wife leaped to safety, but the car was completely demolished. The

ALWAYS IN OPERATION WHEN PUMPS ARE RUNNING

NEW MODEL RUMBA DE-SANDER

ALSO REMOVES SHALE

HUTCHISON MANUFACTURING CO.

6609 AVENUE U HOUSTON 11, TEXAS

Over 50 *Locations in the United States and Canada*

McCullough® REPORTS TO THE OIL INDUSTRY

Service *Anywhere Anytime*

New Services • • • New Tools • • • New Methods • • • Outstanding Results

McCullough Log Saves $40.00 Per Foot Coring Cost in Offset Well

This was well #2 of a drilling program, an offset to the first well in the area which was cored completely. Depth of operation was below 5,000 feet. 5½" O.D. 15 lb. casing had been cemented through the pay zone.

A McCullough Radiation Well Log was run obtaining Gamma Ray and Neutron curves and a simultaneous collar log. McCullough's Logging Engineer computed porosities from the Neutron Log, applied shale and thin bed corrections and located the 18 foot oil zone to be perforated between 5,050 and 5,068 feet. The porosity graphs and slope of the curves were determined from cores from the key well.

108 improved ½" Ogival Bullets were fired in the pay zone, six per foot, by 4¼" O.D. McCullough M-3 Bullet Perforators. Result: A good well, and it took only four hours to complete the logging and perforating.

Other offset wells in the field will be completed in the same way, saving $40.00 per foot in coring costs through the zones that would ordinarily be cored.

This is another fine example of the accuracy and reliability of the McCullough Radiation Well Logger, and its outstanding value as a correlative instrument.

McCullough Log Helps Turn Water Well Into Oil Well

McCullough Radiation Well Logger Accurately Locates 3½ Foot Oil Zone Missed by Previous Log.

While this was a wildcat well, the producing horizon had the same general characteristics as other wells in the basin; the usual gas cap, a very thin oil zone and a transitional zone. It was a typical tough completion problem calling for exact, detailed logging information and "pin point" accuracy in perforating.

First logged and perforated by another service company, the well flowed water. Depth of operation was below 5,500 feet and 5½" O.D. 14.5 lb. casing had been set through the producing horizon.

After squeezing to shut off the water flow, the operator called McCullough. A McCullough Radiation Well Log was run obtaining Gamma Ray and Neutron curves and recording a simultaneous collar log.

The McCullough Radiation Well Logger is the most accurate, reliable and efficient logging instrument available. It has greater stability, provides more detail and assures more accurate quantitative interpretation. You can be sure of exactly locating, defining and interpreting potentially productive formations—thick or thin.

It was found that the previous log had been ten feet deep on casing collars, formation tops and total depth measurements. In addition the log had been interpreted so that the oil zone was shown to be 30 feet into the transitional zone.

The McCullough Log accurately identified and exactly located the gas cap, a 3½ foot oil zone, then the transitional zone. The gas cap contact was perforated for a squeeze shut-off and the 3½ foot oil zone was perforated by ten McCullough Super Formation Glass Jets. The well was then fractured and is now a good, commercial, water free oil well. Total logging and perforating time was only three hours.

There are many actual jobs such as this where the accurate, reliable, easily interpreted information provided by the McCullough Radiation Well Logger has turned a total loss into a profitable operation.

For best results, always call for the McCullough Radiation Well Logger. The most dependable logging equipment available.

McCullough® TOOL COMPANY

Cable Address: MACTOOL

LOS ANGELES
HOUSTON
EDMONTON

OTIS GAS LIFT VALVE

Type C

Largest flow ports . . . smallest O. D. of any available valve

So different from conventional valves we believe it has advanced gas lift technology by ten years.

- Valves can be used for either continuous or intermittent flow
- No metal moving parts — the simplest design of any gas lift valve on the market
- Operated with casing pressure—independent of tubing pressure
- Concentric with tubing—easy to run and pull — no offsets, no unusual shapes
- Available in a wide range of sizes and bore diameters — from 3/4" x 1 3/4" to 2 1/2" x 4"

Your nearest Otis office will be glad to give you additional information and illustrated literature. There is no obligation of course.

OTIS PRESSURE CONTROL, INC.

General Offices and Plant: 6612 Denton Dr., Dallas

Gas Lift Division: 2402 Broad St., Houston

Branches Throughout the Oil Country

WORLD OIL

"So you're the one with the hot temper!!"

shaken woman sat up and surveyed the wreckage. She turned to her husband.

"It's all your fault," she blurted weakly. "If you hadn't told me to stop, I would have."

Blonde Bombshells

"What shall I say about the two peroxide blondes who made such a fuss at the game last night?" inquired the news reporter.

Editor—"Why, just say that the 'bleachers' went wild."

Traveling by Rail

Two gentlemen, under the influence, were creeping home along the railroad tracks one evening.

Said the other—"It isn't the stairs I mind so much—it's the doggone low bannister."

Guide to Living

Practical Nurse: One who falls in love with a wealthy patient.

Freehand Writing

A student reporter on a high school paper, covering a class play, hit the literary jackpot when he wrote:

"The high school auditorium was filled with expectant mothers eagerly awaiting the appearance of their offspring."

Not Too Smart

A visitor stopped in at a local club room to pass the time of day and noticed three men and a dog playing draw poker.

"Sure must be a smart dog," commented the stranger.

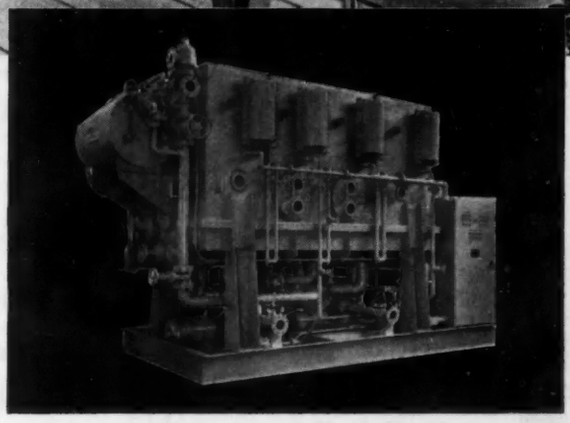
"Naw, he ain't very smart," piped up one of the trio. Every time he gets a good hand he wags his tail."

Bank Inspection

It was a hot day in a small town. The bank inspector who walked into the bank was quite surprised to find no one on duty. Peering into the cashier's office he spied two officials and three clerks playing cards. Determined to teach them a lesson,

The Offshore Company **cuts fresh water costs** *aboard Rigs 54 and 55 with* **Cleaver-Brooks waste-heat evaporators**

The Offshore Company reports, "Cleaver-Brooks waste-heat evaporators aboard our mobile rigs *54 and 55* are producing 1000 gallons of fresh water per hour when drilling. The evaporators are operated at low cost from the waste heat of diesels. The two units have operated continuously without interruption for scale removal since August, 1956, when they were placed in service."



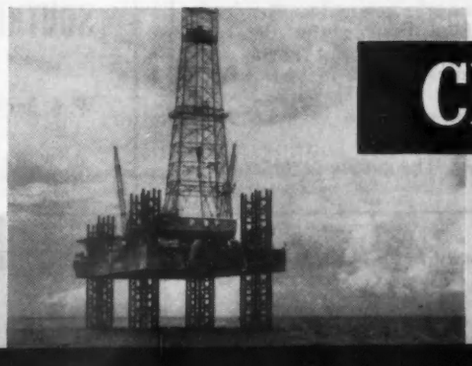
This is a typical 1000 gph, four-stage, waste-heat evaporator — installed in the holds of both The Offshore Company's rigs. Fresh water capacity of Cleaver-Brooks waste-heat evaporators is in direct proportion to diesel engine horsepower.

FRESH WATER FOR ALL ON-BOARD NEEDS!

Cleaver-Brooks waste heat evaporators produce fresh water from sea water, using the waste heat of diesels. Waste energy becomes *working* energy!

If you have been paying 25¢ a barrel for barged water, you can save thousands of dollars annually by producing your own fresh water right on board. Fresh water capacities of waste-heat evaporators are in proportion to diesel engine horsepower.

For more information call MOhawk 4-1336, Houston, Texas. Or write Cleaver-Brooks Company, Special Products Division, 369 E. Keefe Ave., Milwaukee 12, Wis., U.S.A. Cable Address: CLEBRO — Milwaukee — all codes.



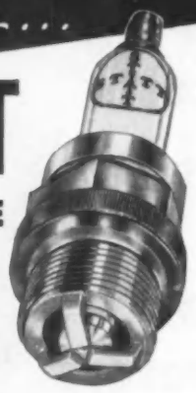
One of the two new Offshore Company rigs. Units are in service in the Vermillion Area and Galveston Area of the Gulf of Mexico. Three 875-hp diesels supply d-c power and two 45-hp diesels supply a-c power.

Cleaver Brooks

BUILDERS OF EQUIPMENT FOR THE GENERATION AND UTILIZATION OF HEAT AND POWER

COOPER-BESSEMER
uses . . .

STITT
NEW TRIPLE IGNITOR
SPARK PLUGS



. . . to get peak performance longer, Cooper-Bessemer is now factory-installing STITT New Triple Ignitor Spark Plugs. STITTS last up to 10 times longer, cut downtime, increase magneto life. Also factory equipment in other leading oil field engines.

Write today for FREE Pocket Catalog giving recommended plugs for all your engines—help you get better plug performance.

STITT IGNITION CO.
COLUMBUS 1, OHIO
STITT MAKES HEAVY-DUTY, INDUSTRIAL-TYPE PLUGS!

INCREASE PRODUCTION
CLEAN OUT CHOKING SAND

Excessive sand and sediment holds back your oil. For fast, easy clean out with fewer round trips and less downtime, use world famous Miller Sand Pumps.

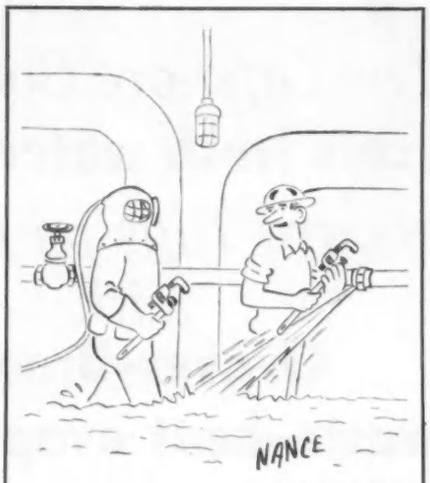
SAND PUMP SIZES
O.D.—2½, 3, 3½, 4¼, 5, 5½, 7 In.
Lengths—20, 25, 30 ft.
Composite Catalog, Page 3369

Write for descriptive price list

MILLER SAND PUMPS

Miller Sand Pump Co.
General Offices, Box 4516
Oklahoma City 9, Okla.

EXPORT OFFICES
30 Rockefeller Plaza
NEW YORK CITY 20, N. Y.



WORLD OIL
"The leak's not quite that bad, Murph!"

the inspector tripped the burglar alarm and hid in a vacant office. Hardly had the clang of the alarm died away when the doors of the tavern next door popped open.

"Coming right up, gents," called the bartender, entering the bank balancing a tray with five foaming mugs of beer.

Too Much Gas

The banker who had gone to a doctor for a physical checkup was told to get out into the open air, so he quit his job at the bank after 35 years and bought a filling station.

The first morning he was open for business a man drove in and asked for ten gallons of gasoline.

"Where are you going?" asked the former banker.

"To Tulsa and back," was the answer.

The banker looked at him sternly and said, "Don't you think you can get along on five gallons?"

Double Meanings

"Fifty guests assembled at the Domestic Forum, and thirty have been married to the same man for more than twenty years."

Creation

The reason God made woman after he made man was that He didn't want any advice.

How to Order Your 1956 Index

A complete editorial index covering all issues of WORLD OIL published during 1956 has been compiled and bound separately in convenient pamphlet form. It will be sent free to all subscribers requesting copies.

To get your copy, address orders to the Librarian, Gulf Publishing Company, Post Office Box 2608, Houston 1, Texas. Or if you prefer, you can use the convenient Readers' Service Blue Postcard on the last page of this issue. Just check the square indicated. Fill in your name and address. Drop the postage-paid card in the mail and the index will be sent you.

Act now. The supply is limited.

Definition

City girl: "Where does virgin wool come from?"

Farmer: "From sheep that can run the fastest!"

Small Remembrance

John went calling on the widow of his best friend who had recently died.

"Joe and I were mighty close friends. Isn't there something I could have to remember him by?"

Tearfully, the widow raised her eyes and whispered softly, "Would I do?"

Good Performance

The director was talking in his sleep. "Darling, I love you," he said. "You are my life, my heart. More than anything else in the world . . ."

Then he woke up and saw his wife glaring at him. Knowing what the trouble might be he pretended he was still asleep, rolled over and murmured, "Cut! Now bring on the horses."

SECONDARY RECOVERY
Since 1922

PETROLEUM ENGINEERS
CABLE ENGINEERING
WICHITA FALLS, TEXAS

RESERVOIR ENGINEERING
Water Flooding Gas Repressuring
EVALUATION CORE ANALYSIS
SURVEYS ECONOMICS
Cost Estimates, Design, Installation
FIELD SUPERVISION
Phone 3-2167

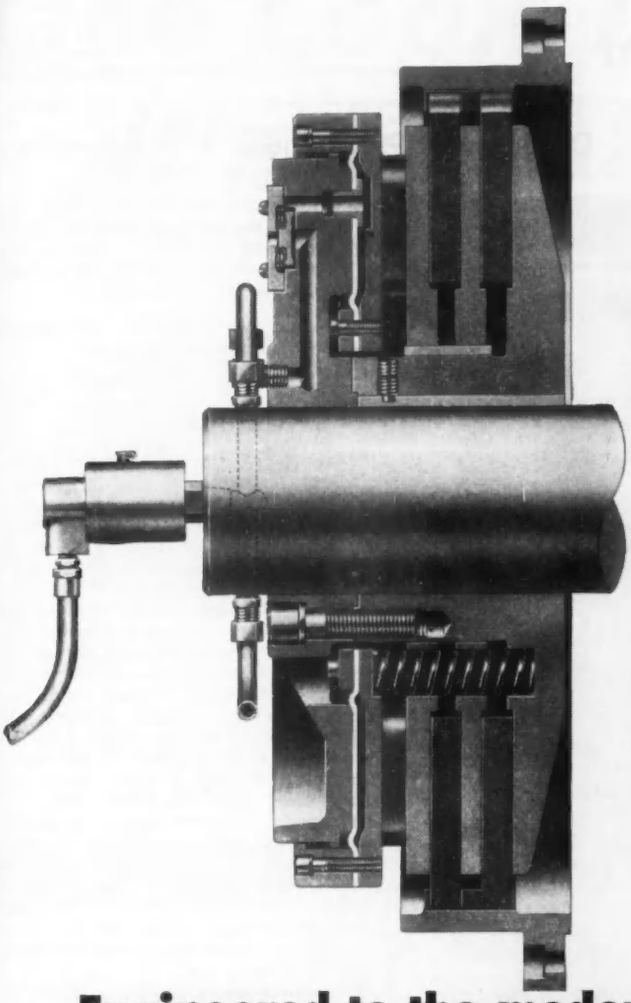
HYDROCARBON WELL LOGGING

Domestic and Foreign

CARAN ENGINEERING CORPORATION

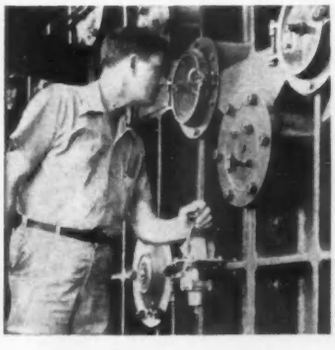
MILAM BLDG. SAN ANTONIO
Branch Offices: Houston and Alice, Texas and Lafayette, Louisiana

COMPLETE
production testing
AND
wireline service
☆
SOUTHERN ENGINEERING SERVICE
P. O. Box 4296, Corpus Christi, Texas
phones
G. W. TAYLOR TU-3-1138
JNO. D. BERRY TU-3-1138
LEROY LANE UL-2-5786



DODGE AIR-GRIP CLUTCH

Engineered to the modern demand, a *New Air Clutch* ...with amazing sensitivity...compact...cooler in operation...built-in quick release valves...



Finger tips on the throttle bring instant response, give the operator split-second control. This new product of Dodge is the quickest-acting air clutch available!

New design and engineering by Dodge achieve this exceptional control—in a clutch that provides maximum torque capacity in minimum space. Less air is used to operate the clutch—the result is a new sensitivity that enables the operator to "inch" the clutch, or to throw it into full engagement as required. Where instant disengagement is needed, quick release valves are built into the clutch itself, as optional equipment.

The unique design of the Air-Grip Clutch places the air seal disc at the end *farthest* from the pressure plates, which generate the heat inherent in clutch operation. This, combined with automatic internal ventilation, insures cooler operation and longer life under severest service. Provision is made for mechanical engagement of the clutch if the air supply should fail.

Thorough tests in the field as well as in the laboratory assure you of Dodge dependability in the Air-Grip Clutch. Available in sizes from 8.5 to 460 hp at 100 rpm at 80 psi. Call your local Dodge Distributor or write for Bulletin A634.

DODGE MANUFACTURING CORPORATION
6500 UNION STREET, MISHAWAKA, INDIANA

DODGE
of Mishawaka, Ind.

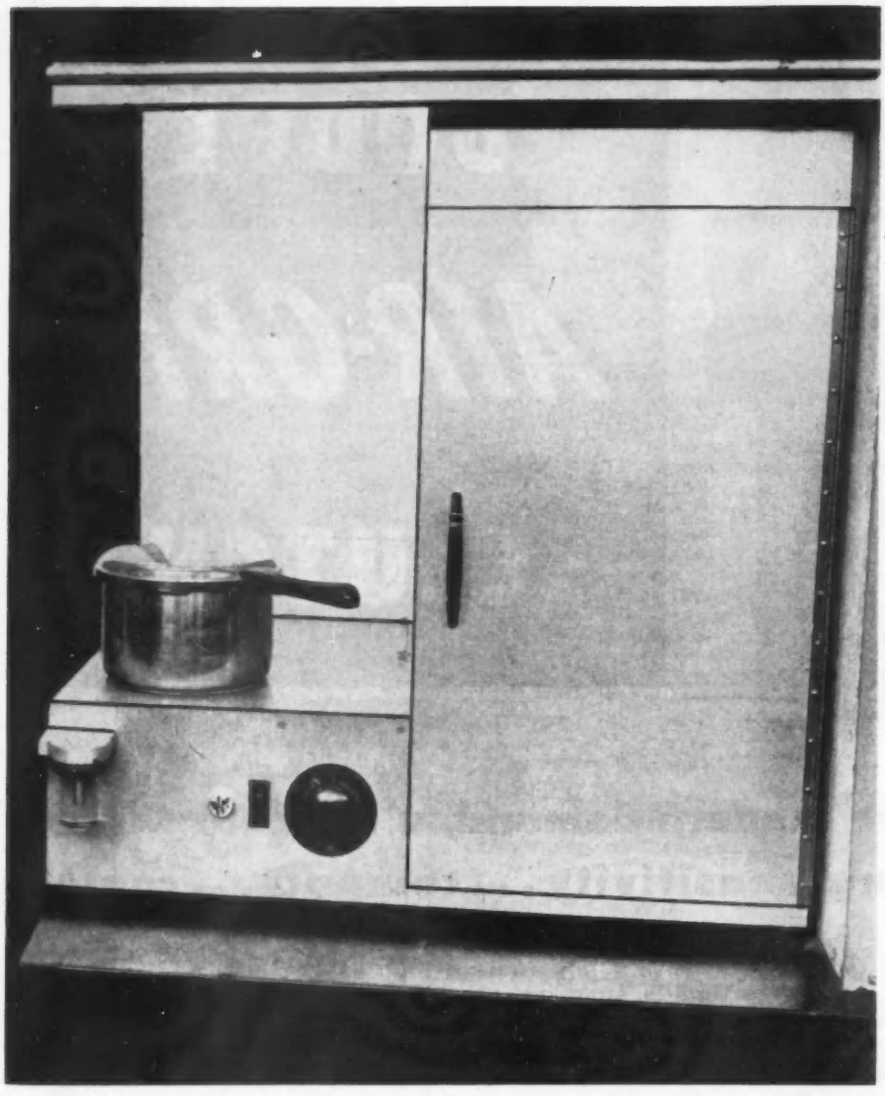
Sixty years of experience in serving industry's clutch needs . . . manufacturer of the famous Dodge Diamond D and Rolling Grip mechanical clutches.

Call the Transmissioneer, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified telephone directory, or write us.

For more data on advertised products, use Readers' Service Cards, last page.

What's New In Equipment

Drilling • Production • Exploration



Centrifuge Core Cleaner

This new centrifuge core cleaner is adaptable to cleaning any type of porous material, such as filters, where 100 percent of carbon contaminate must be removed. In recent tests, cores of approximately even porosity (18 to 23 percent) were saturated with 40 gravity oil. Permeability of these sample cores ranged from 11 to 62 md. After approximately 20 minutes the new centrifuge core cleaner had removed 100 percent of the oil whereas a soxhlet extractor had removed only 20 percent of the oil. After 41 hours in the soxhlet extractor only 83 percent of the oil had been removed.

The core samples are placed in a flat disc container which is then attached to a cone fitted to the shaft of the motor. Both the outer rim and the hollow hub of the basket contain perforations for the passage of the solvent and extract. The solvent is delivered to the perforations by means of a stainless tube inserted into the hollow hub.

When the centrifuge cover is locked into place, the centrifuge is slowly brought to the desired speed. Hot solvent is allowed to flow by gravity from the condenser above the solvent still to the siphon bottle.

Solvent striking the face of the core samples emerges with the dissolved oil (or hydrocarbon contaminates) from the opposite face. This extract is returned to the still through a glass observation cell which permits visual observation of the extraction process. The solvent used is chloroform which has the advantage over most hydrocarbon solvents in that it is not explosive and has less tendency to alter the surface wettability characteristics of the samples.

The core basket will hold up to 18 1-inch samples, cubical or cylindrical. The centrifuge is self balancing to prevent injurious vibration when less than the maximum number of samples are being cleaned.

The complete unit consists of the centrifuge unit (A) operated by a ½ horsepower motor rated at 18,000 revolutions per minute, and the solvent still (B). If desired, the centrifuge unit can be purchased without the solvent still. Both the centrifuge and the still are manufactured in right hand and left hand units and can be bolted together to fit under a standard exhaust hood (see illustration).

For more data, circle **No. E1** on Readers' Service Card, last page this issue.

Iron Powder Electrode

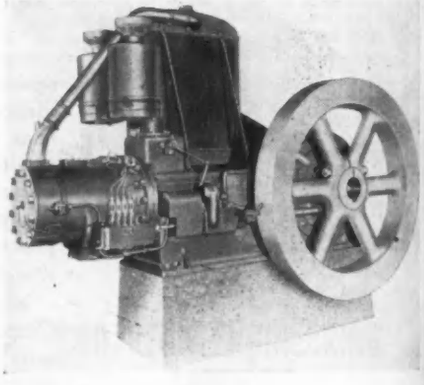
The Lincoln Electric Company of Cleveland, Ohio, announces a new all-position, low hydrogen, iron powder type electrode called **Jetweld LH-70**. It is an electrode for general purpose welding of all steels with high currents and for welding crack-sensitive steels and steels tending to produce porosity in weld metal. It has the usual low hydrogen advantages, plus those of iron powder electrodes: high deposition rate, easy slag removal, and excellent operating characteristics. Typical uses are for welding low alloy steels which must be welded without preheat, high sulphur-free machining steels, steels to be enameled, medium to high carbon steels and thick sections.

Iron powder in the coating produces deposition rates which result in welding speed 10 percent to 30 percent higher than those obtained with low hydrogen electrodes without iron powder. The coating produces greater footage per electrode and, therefore, necessitates fewer electrode changes.

Ease of operation is characteristic in all positions with either DC electrode positive or AC welding current. Bead appearance is smooth and clean, spatter being reduced to an unimportant minimum. Slag is easily removed. Either a drag technique or a short arc technique can be used.

The electrode is classified as an A.S.W. E-6016, but it also meets the requirements of classes E-6015, E-7015 and E-7016. It is available in ⅛, 5⁄32, 3⁄16, 7⁄32 and ¼ inch sizes.

For more data, circle **No. E2** on Readers' Service Card, last page this issue.

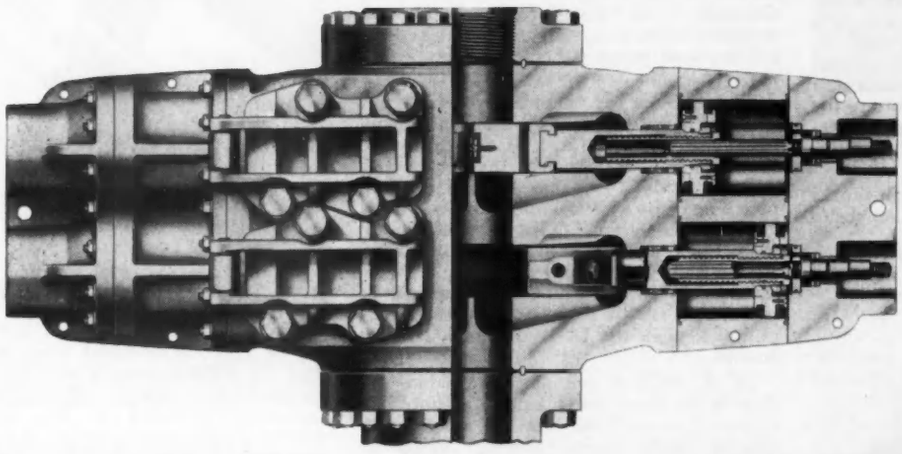


Gas Engine

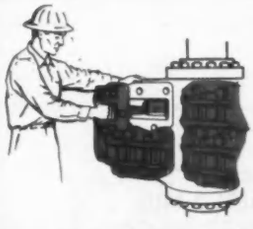
A 115-working horsepower gas engine designed to handle the heaviest oil field assignments has been introduced by Ajax Iron Works. The Ajax DP-115 delivers

One Look Tells You it's SHAFFER

. . . THE CELLAR CONTROL GATE THAT'S YEARS AHEAD



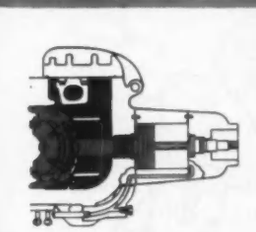
The Shaffer Hydraulic Cellar Control Gate is so unique that you can see many of its important advantages with *one* quick look . . .



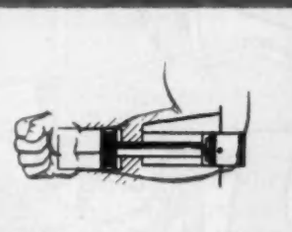
SIDE-OPENING DOORS assure you maximum ease in changing rams. Simply unbolt and open the door, slide out the ram assembly, service the rams, and slide the assembly back in place. Closing and bolting the doors automatically aligns the rams for proper operation.

Equally important—rams can be changed with the same ease whether pipe is *in* or *out* of the hole!

SPACE-SAVING COMPACTNESS saves costly cellar space, assures more efficient hook-ups. Even in sizes as large as 13⅝" (12" Series 900) the Shaffer Double Gate, with *two* ram compartments unitized into one body, requires only 30" of vertical height—the Single Gate only 18½". Width and length dimensions are also unusually compact, saving valuable cellar space in all three dimensions!



ONE PISTON PER RAM (as seen here from the top view) means . . . (1) fewer and simpler operating parts . . . (2) fewer hydraulic seals to maintain . . . (3) simpler manifolding of hydraulic lines . . . (4) easier servicing . . . and (5) more-favorable ratio of piston area to piston circumferential seal (hence, less internal friction, greater efficiency)—advantages not found in more complicated designs.



DIRECT HYDRAULIC DRIVE with the operating cylinders directly *behind* the rams—not on the sides—assures positive action, maximum simplicity and greatest safety. There are no complex mechanisms, no yokes, no secondary connections between the hydraulic cylinders and the rams in Shaffer Hydraulic Cellar Control Gates . . . still another important engineering advantage.

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops: Santa Fe Springs and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Shaffer Tool Works, 6201 South Shields Boulevard
FARMINGTON, NEW MEXICO, Shaffer Tool Works, Post Office Box 546
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 1788
EXPORT SALES OFFICE: Shaffer Tool Works, 500 Fifth Avenue, New York, N. Y., U. S. A.

34 years OF OIL TOOL LEADERSHIP

BUT DON'T STOP at the Shaffer advantages you can see from the outside. Take a look, too, at operating advantages *inside* the Gate . . . features such as Self-Draining Compartments that prevent detrimental accumulation of mud and sand . . . choice of Rising or Non-Rising Locking Shafts (depending upon whether you prefer the quick indication of ram position provided by Rising Shafts, or the greater compactness of Non-Rising Shafts) . . . and many other important advantages.

No matter what you pay, you can't buy better, more advanced cellar control gate equipment than Shaffer. So before you buy, be sure to get the *complete* story on Shaffer's multiple advantages. Your nearest Shaffer representative will gladly supply complete details. Or write direct!

See the Shaffer Section of your Composite Catalog.

Send for your free copy of the latest Shaffer Catalog!

15 percent more power, at greater fuel savings, than the largest engine previously offered by the company. Bore is 13¼ inches, stroke 16 inches.

The engine maintains an essentially flat torque curve, delivering required horsepower to operated pumps or other equipment over a wide speed range. Speed is variable to meet operating conditions. Recommended speed range is 200 to 360 rpm.

Directional porting of cylinder intake ports is a design feature. This sweeps the maximum amount of exhaust gases from the cylinder by accurately targeting incoming gases, thus achieving exceptional scavenging efficiency. Other features are thermo-syphon cooling, dual air filters for the combustion chamber, and shorter overall length and width. Gas injection equipment is optional.

(This item supplements Ajax Iron Works data on Pages 144-145 of the Composite Catalog, 21st Edition.)

For more data, circle No. E3 on Readers' Service Card, last page this issue.

Mobile Field Unit

The recent Los Angeles convention of the American Association of Petroleum Geologists gave the introduction of the new Geo-Lab, a mobile laboratory and living unit, produced by Flintridge Motor Manufacturing Co.

The Geo-Lab is custom designed for use in field research. It combines laboratory and living facilities with rugged D. K. W. engine and body construction for use in the field. The unit, manufactured in the U. S., is mounted on a German made D. K. W. auto union cab and frame. According to the designer and builder of the Geo-Lab, it is ideal for uses in the oil industry, mining, logging, surveying, prospecting and many other industries where research teams are needed in the field.

The 350 cu. ft. laboratory-living unit includes a full-length bed, desk and drawing board, cooking facilities, toilet, storage space, and laboratory working space. The unit sits only 14 inches off the ground, providing easy access and a low center of gravity, which enables it to cross rough, steep angle terrain with maximum safety. Added safety is achieved by D. K. W.'s front wheel drive which pulls instead of pushing. A slight pressure on the accelerator will keep the D. K. W. on a straight course.

D. K. W.'s 3 cylinder, two-stroke engine is the latest development of simplified engine construction. Having only seven moving parts, engine trouble caused by friction is at a minimum. Since, in a two-stroke engine, each downward movement provides power, the three-cylinder D. K. W. engine is, in effect, achieving the performance of a six-cylinder engine of normal design.

For more data, circle No. E4 on Readers' Service Card, last page this issue.

Polyethylene Safe-T-Clad

New Safe-T-Clad tape extruded of Tenite polyethylene and manufactured by The Seamless Rubber Company is an advanced modern medium for impeding pipe corrosion. Wrapped on pipe for a great variety of industrial uses, it is said to insure protection for years. The polyethylene material permits little or no moisture absorption or penetration. And, according to the manufacturer, the tape resists electrolytic attack and microbiological deterioration, and does not leach out when buried in the earth.

Another advantage of the tape is its ease of application by either manual or mechanical means. No special condition-

VERY HIGH HYDROPHILE-LIPOPHILE BALANCE VALUE...VERY EFFECTIVE IN SOLUBILIZING OIL IN WATER
WHAT'S ALL THAT MEAN?
TALKING ABOUT SEECO-MUL...BEST EMULSIFIER WE'VE EVER USED
"SEECO-MUL MAKES A GOOD MUD BETTER"
50 lbs. Net
DRILLING MUD EMULSIFIER
Seeco-Mul

ing, as with heat, is required. A non-corrosive adhesive compound that is bonded to one side of the polyethylene makes it ready to use. The tape has an "elastic memory," or elongation. Wrapped spirally on pipe, with proper tension, it gives a tight, firm coating.

Safe-T-Clad tape is available in 100-ft. rolls—in widths of 1, 2, 4, or 6 inch—for such industrial users as the petroleum industry, utilities companies, bleacheries, soap and detergent manufacturers, chemical companies, platers and the plumbing trade.

For more data, circle **No. E5** on Readers' Service Card, last page this issue.

Fire Protective Asbestos

Kamklad, a new fire protective, aluminized asbestos cloth which reflects over 90 percent of radiant heat has been introduced to the market by Keasbey & Mattison Co., manufacturer of a complete line of asbestos products.

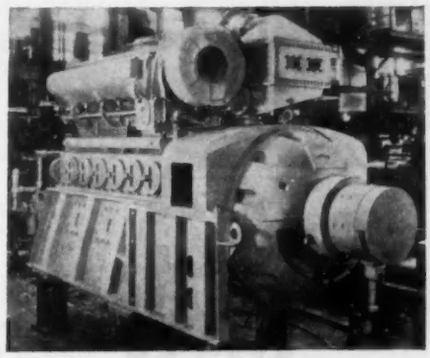
Safety garments made of Kamklad make it possible for the wearer to withstand temperatures in excess of 2500° F. without discomfort or ill-effect. They cut down injuries, save hours of labor because of the drastic reduction of heat fatigue and enable wearers to do jobs in emergencies that would be otherwise impossible.

Field tests of this aluminized asbestos cloth have proved its worth in many uses. Tests in steel mills have disclosed that this new fire protective cloth makes it possible to change ingot reheating furnace doors while operating at 2100° F. Also, only one melter is necessary on the electric furnace the full 10 minutes of the slagging-off period. Previously a man had to be relieved every two minutes. A utility company tested a Kamklad safety garment by having a man walk through a 2500° F. propane fire in order to extinguish it. The test was successful and he accomplished the job without difficulty.

Kamklad is a tightly woven asbestos cloth surfaced by a special process with a heat protective aluminum foil. The smooth aluminum foil surface reflects over 90 percent of all radiant heat with which it comes in contact thus shielding the wearer from this major hazard. Flying sparks and cinders fall right off without damaging the material. It resists water, oils, and, to all practical purposes, has the same corrosion-resistant qualities as the aluminum with which it is covered.

In addition to its use in protective garments Kamklad has many other applications such as fire baffles in industrial plants, aircraft hangars and garages. It can also be used as fire protective curtains in welding booths, refractories, kilns and in other similar high temperature areas where protection from heat is necessary.

For more data, circle **No. E6** on Readers' Service Card, last page this issue.



Main Power Diesel Engine

The Worthington W9 Engine is a small, heavy-duty, four-cycle, compact unit with 400-1400 horsepower for power in utility service, water works, chemical and petroleum plants and wherever economical power is desired.

Fully assembled upon delivery, the W9 "Power Package" is ready to be placed upon its foundation and requires no major aligning. The alignment is done at the factory, minimizing installation time and expense. Constructed for continuous operation, Worthington's W9 is designed for high-output turbo-supercharged operation.

The Jet-Swirl design involved, swirls the air as it enters the cylinder, thus assuring a rapid mixture of the air and fuel, resulting in efficient and clean combustion.

(This item supplements Worthington Corp. data on pages 5337-5356 of the Composite Catalog, 21st Edition.)

For more data, circle **No. E7** on Readers' Service Card, last page this issue.

in 4 out of 5 wells you can drill better with Seeco-Mul

In almost all areas – and in 80 per cent of the wells – operators are finding that they can make hole faster and make a better well with emulsion muds. Seeco-Mul, added in quantities of 2 to 3 lbs./Bbl., effectively disperses the oil in the system which increases drilling rates, makes better hole conditions, drills into pay formations better, affords better coring, and makes a better completion. These factors are especially important in completions with low pressures and low permeabilities. Seeco-Mul is particularly recommended where water muds would impair the productivity or swell the sands in water-sensitive horizons.

Seeco-Mul readily emulsifies Diesel or crude oils in sodium or limed muds. It is temperature-stable, it has a low water loss at high temperatures, and any qualified mud engineer can use it without special instruction or extra equipment.

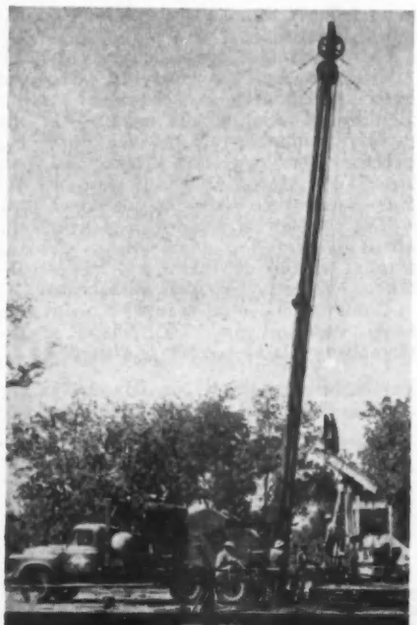
Seeco-Mul has a number of other advantages which your local mud dealer will be glad to tell you about – or write to us; we'll be glad to send you full particulars and a lab sample without obligation. Crossett Chemical Company, P. O. Box 271, Crossett, Arkansas.

faster, straighter penetration...better lubrication...lower pump pressures with Seeco-Mul

DRILLING MUD EMULSIFIER

Designed to

$ STOP PROFIT LEAKS in Well Servicing



WICHTEX
Well Servicing Units

ENGINEERED
for simplified operation and upkeep

RUGGED
for long trouble-free life

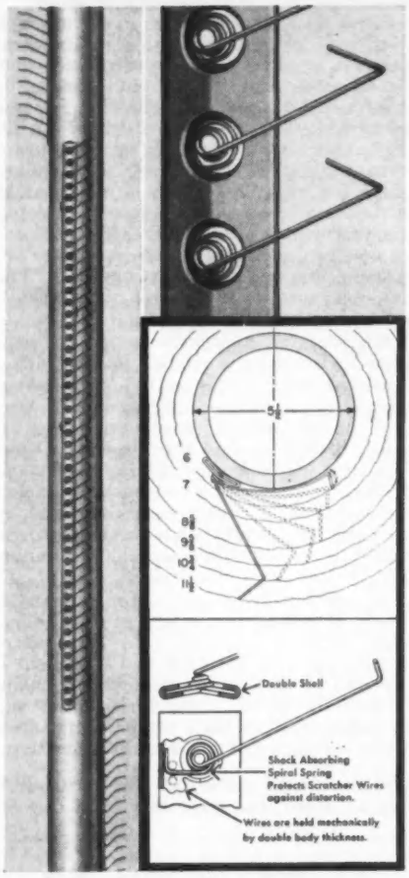
REASONABLY PRICED
for fast pay-out

Models range from 2,000-foot to 12,000-foot capacity.

WRITE FOR NEW CATALOG NOW

WICHTEX MACHINERY COMPANY INC.
WICHITA FALLS TEXAS
Box 2250 Ph. 2-8612

PRODUCTION



Rotating Wall Scratcher

For operators who prefer to remove mud cake with a rotating type wall scratcher, Baker Oil Tools, Inc., has designed a scratcher with wires that always present a scratching point to dig in and effectively remove the mud.

The scratcher wires adjust to a wide range of clearances, and maintain an effective scratching point, even under slim hole conditions. The scratcher wires of a Baker rotating wall scratcher, mounted on 5½-inch casing, successfully attack the wall of any hole size from approximately 6 inches to 11½ inches.

Each sturdy wire is held mechanically in the double shell of the body of the scratcher and then formed into a shock absorbing spiral spring to prevent permanent distortion of the exposed portion of the wire.

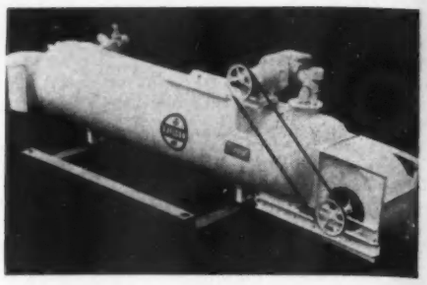
The strong, double-shell scratcher body is readily tack-welded to the casing throughout the area to be cemented. Successive scratchers on a given joint of casing should be spaced 120 degrees apart horizontally around the circumference, but mounted end to end vertically, with or without overlap, as desired.

(This item supplements Baker Oil Tools, Inc. data on pages 469-600 of the Composite Catalog, 21st Edition.)

For more data circle **No. E8** on Reader's Service Card, last page this issue.

Hot Climate Reservoir Tank

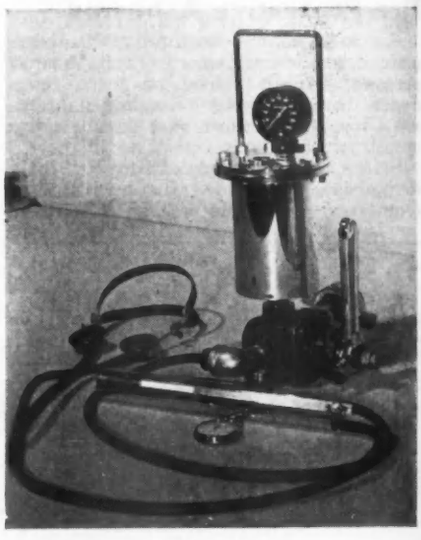
An air-cooled, ducted reservoir tank is now available for installation on Axelson hydraulic pumping units with 6-foot and 10-foot strokes. In hot climates and under certain conditions where the temperature of the hydraulic oil would ordinarily be



high, the Axelson Ducted Tank is a necessary accessory. When extreme heat conditions prevail it prevents the breakdown of the oil and the overheating of precision components in Hydraulic pumping units.

The tank holds approximately 150 gallons and is furnished with or without the blower and return vent. The blower is used to force high velocity air through and over the ducted tank, thus providing the maximum amount of cooling. The Ducted Tank and Hydrax Pumping Units are manufactured by the Axelson Manufacturing Company, Division of U. S. Industries, Inc., Los Angeles. Calif.

For more data circle **No. E9** on Reader's Service Card, last page this issue.



Fluid Level Measure

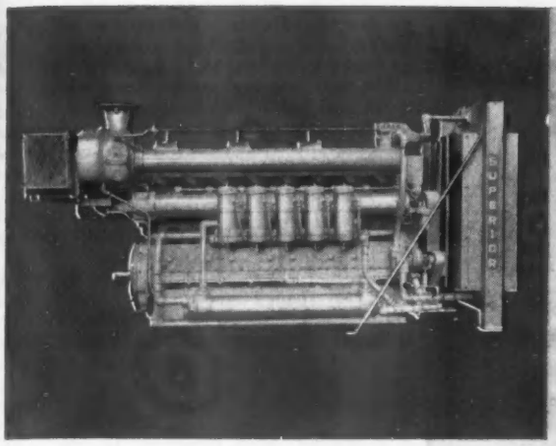
The Nu-Tec Manufacturing Co. of Los Angeles announces a new fluid level measuring instrument for the petroleum industry. This instrument, known as the Fluid Log, features accuracy, simplicity of operation, rugged dependability, portability and low cost.

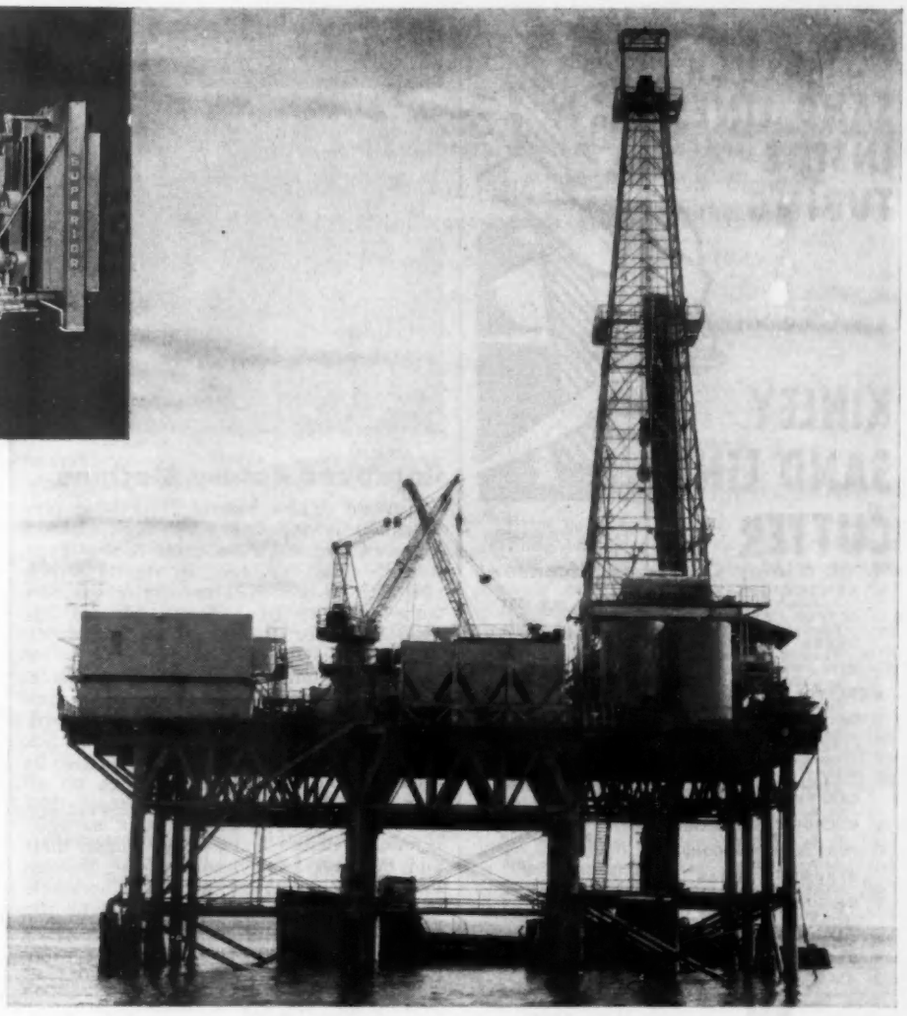
The Fluid Log, is entirely non-electrical, and operates by measuring the time required for a pressure pulse to travel down the well anulus to the top of the fluid and be reflected back to the surface. A means of calibrating the speed of sound for the gas and pressure conditions of each individual well provides maximum accuracy.

A complete operation, including calibration, measurement with the Fluid Log, and determination of well depth may be performed by a field man in less than five minutes on any well having pressures from a few ounces to 250 pounds per square inch or a vacuum.

The complete unit, including the Fluid Log instrument, calibrator, notebook, stopwatch and case, weighs less than 30 pounds.

For more data circle **No. E10** on Reader's Service Card, last page this issue.





powered by White's Superior Diesels . . .

SHORELINE'S RIG 7 DRILLS TO SUPER-DEPTHS

Tremendous depths, restricted only by present drill pipe and drilling methods, are reached by Shoreline Drilling Company's new Marine Rig 7, located in the West Delta Area off the Louisiana Coast. For prime power on this isolated Gulf platform, where drilling is being done for the CATC Group, Shoreline wisely chose three White PTDS-8 Supercharged Superior Diesels, each rated at 800 B.H.P.

Greater operating economy and dependability with White Diesels assure more profitable and continuous development drilling. Moreover, the up to 30% power increase in the newly improved Super PTD's gives greater working ability, more lugging power and faster acceleration. Yet engine size is not increased, resulting in less weight and less cost per horsepower.

Many other new design and engineering features make White Diesels outstanding for rugged, efficient, low-maintenance service. Superior Diesel, Dual Fuel or Gas oil field engines are available from 320 to 2150 B.H.P. Get the facts from leading rig manufacturers, White Diesel representatives in oil field areas, or the White Diesel Engine Division general office.

White Diesel

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY

Plant and General Offices: Springfield, Ohio

For more data on advertised products, use Readers' Service Cards, last page.

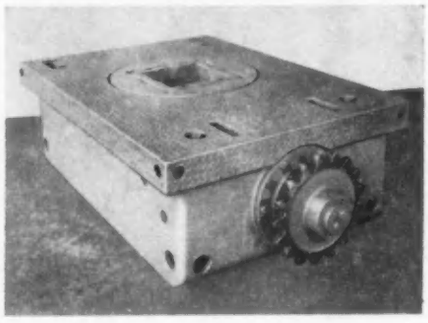
CUT STUCK SAND LINES INSIDE TUBING

KINLEY SAND LINE CUTTER

M. M. Kinley Company, Licensees

ABILENE, TEXAS
Hudson-Eads, Inc. 2-8331
CORPUS CHRISTI
Tobokut Wireline Services.....5-1811
HOBBS
Horne Well Service Co.....3-3396
MIDLAND
Luccous Service & Equipment Co.....2-1631
PETTUS, TEXAS
Eddie Jones Engineering Co..16 or Beeville 1547
OKLAHOMA CITY
Rainbo Service Co.....ME 4-2131, ME 2-3045
LIBERAL, KANSAS
Rainbo Service .....Main 4-3590
WICHITA FALLS
Hudson-Eads, Inc.....2-3767, 2-8584, 3-4090
CASPER, WYOMING
C. A. White.....3-5264
GLENDIVE, MONTANA
C. A. White.....EMpire 5-3833
FORT MORGAN, COLO.
C. A. White.....819
BEAUMONT, TEXAS
ASEE Co.....TE 5-7046
KILGORE, TEXAS
B. M. Davis.....5541
WHITTIER, CALIFORNIA
Kline Wire Line Co.....OX 8-2731

DRILLING



Improved Rotary Machine

First of a new line of National rotary machines is announced by The National Supply Company, Pittsburgh. A new Type SA-175 rotary machine in the 17½-inch size with 44-inch API spacing of sprocket from table center has replaced the FE-17½-44 for shallow and medium depth drilling.

Several improvements have been made. First is the rectangular shape of the machine, including the removable top guard. This simplifies installation in the derrick substructure and permits rig flooring to be fitted up flush with the table top on all four sides for safer working areas.

A cartridge type pinion shaft assembly is another design feature. The pinion shaft and bearings have been made a unit assembly in a cast steel housing. The whole unit is removable from the end of the base where it is held in place by a bolted end plate. This assembly assures permanent alignment of bearings and an easy means of adjusting the pinion with the gear without disturbing alignment.

Another important feature is a Unitized table and bearing assembly in which the main and hold-down bearings are mounted in the rotary. The bearing assembly has been simplified because the lower race of the main bearing acts as the upper race of the hold-down bearing. This design permits removal of the table assembly and all bearings from the housing without disturbing the working position.

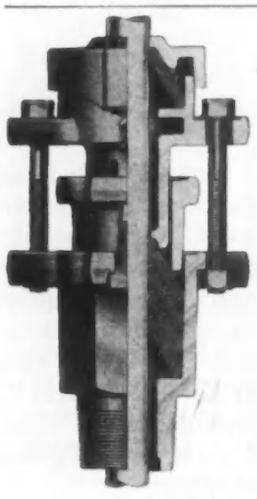
A direct table lock is provided by means of evenly spaced recesses or notches around the outer perimeter of the table. Two independently operated locking pawls at the sprocket end of the rotary lock the gear table against rotation in either or both directions. Direct locking prevents tonging shocks and strain on the pinion, gear, and pinion shaft bearings. It has eliminated the use of a lock ring on the pinion shaft.

Accessibility of all fittings and operating parts from the top of the table guard is another advantage of the SA-175 rotary. These parts include lock pawl handles, oil filler cap, dip stick and lifting trunnions. The rotary is handled by these trunnions on one end and a sling around the pinion shaft bearing retainer on the opposite end. These features contribute to more convenient operation as well as simplify installation, inspection, maintenance, and removal from the rig floor.

Positively induced oil circulation for pinion and gear, main, hold-down and pinion shaft bearings is a new feature. No grease is used for lubricating the SA-175 rotary.

(This item supplements The National Supply Co. data on pages 3525-3620-A-B-C-D of the Composite Catalog, 21st Edition.)

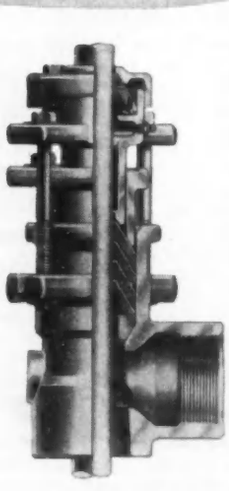
For more data, circle **No. E11** on Readers' Service Card, last page this issue.



ONE OF THESE
Hercules Stuffing Boxes
CAN END YOUR PUMPING WORRIES*

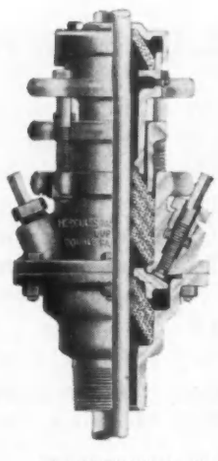
"REGULAR TYPE" DUPLEX POLISHED ROD STUFFING BOX

The old reliable, tried and proved on thousands of wells from coast to coast and in foreign fields.



"TEE BASE TYPE" DUPLEX POLISHED ROD STUFFING BOX

A combination Stuffing Box and Pumping Tee. Makes a short connection. Bolt lugs are placed low to eliminate fouling of elevator links. No bell nipple needed as top of body will support elevator. Full opening — unnecessary to remove body when pulling or running rods.



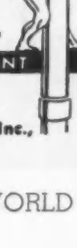
"TYPE OP" DUPLEX POLISHED ROD STUFFING BOX

A Double Packed Stuffing Box for use on high pressure wells and those that flow intermittently. Especially desirable for wells located near buildings, fire hazards of growing crops. Two compression bolts, in bottom sections, are tightened on Cone Rings to pack-off while replacing packing in upper section.

All HERCULES Stuffing Boxes are made of high grade malleable iron which prevents shattering if rods drop. They are tested to 3,000 pounds psi pressure and all use the famous HERCULES Split Cone Packing Rings.

HERCULES OIL RESERVOIR UPPER GLAND

* All HERCULES Stuffing Boxes may be equipped with Oil Reservoir Upper Glands on "problem" wells which pump-off and burn the packing. The polished rod moves through the oil in the reservoir which lubricates and cools it.



HERCULES TOOL Company
"MANUFACTURERS OF OIL FIELD EQUIPMENT" SINCE 1924
GENERAL OFFICES AND PLANT TULSA, OKLAHOMA
Export Representative: Oil Field Equipment Co., Inc., 30 Church Street, New York 7, N. Y.

New Equipment Catalogs and Literature

For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Reader's Service postcards just inside the back cover and facing the Advertisers Index. Simply circle code numbers of items desired—sign and mail card. Requests are transmitted to the manufacturer as soon as received by us for mailing of desired information directly to you.

Bottom Hole Sampler

Bulletin 217 describes new stainless steel sampler for use in oil wells. Operated from the surface, it gives positive indication of sampling depth. It takes one liter sample with over-all length of only 67 inches. Simple transfer procedure does not require use of mercury. The bulletin is put out by the Coleman Instrument Company.

To get a copy, circle **No. E12** on Readers' Service Card, last page this issue.

Integrated Data Guide

How businesses of any size can select the correct integrated data processing system for their specific needs is explained in a new booklet announced today by Ditto, Incorporated, Chicago manufacturer of office duplicating equipment. Titled "Integrated Data Processing: A Factual Analysis," the 24-page booklet discusses one-writing systems, punched cards, magnetic and punched tapes, telegraphic transmission, and electronic computers.

A major point stressed is that integrated data processing equipment should be carefully chosen for the needs of a particular business. Larger firms can make profitable use of elaborate electronic equipment. Other firms may find such equipment wasteful of time and money. For many firms, a one-writing direct process or offset duplicating system is recommended.

The booklet also points out that practically all equipment involved in office automation can be linked to one another. This makes it possible for a growing business to add and adapt IDP to meet its needs.

To get a copy, circle **No. E13** on Readers' Service Card, last page this issue.

Flexible Coupling Catalog

Torsionally flexible, Morflex couplings are fully described in a new 24-page catalog. The Morfiex principle, employing preloaded rubber biscuits as the flexible medium, is explained and illustrated. Complete dimensions and specifications are given on standard, double and radial type couplings with additional data on coupling driveshafts.

Torsional deflection charts and instructions for use explain the method of coupling selection in controlling the torsional vibration of a system.

To get a copy, circle **No. E14** on Readers' Service Card, last page this issue.

Metering, Testing Catalog

Oil Metering and Processing Equipment Corporation has published a 12-page catalog covering its full line of metering and testing equipment products. The catalog is offered free-of-charge to qualified personnel of oil and gas producing companies.

The equipment described includes metering separators, Vol-U-meters, well testers, automatic well testing system, automatic custody transfer, automatic lease equipment, Weigh-O-Matic Meters, and Metering Free Water Knockouts. The catalog is complete with specifications, operating procedures and applications.

Of special interest is the section on the firm's automatic lease operation well testing system. The well testing system, designed and engineered by Oil Metering personnel, is practical and has been proven in major oil fields.

To get a copy, circle **No. E15** on Readers' Service Card, last page this issue.

High-pressure Pump Folder

Twentieth Century Manufacturing and Supply Co., Tulsa, announced their new Series 5000 Triplex plunger pump for working pressures up to 10,000 psi. Complete details are available in a new folder.

This new pump was designed at the insistance of some oil well service companies for which 20th Century was making pump fluid ends. They wanted a pump body which would stand up better under the rugged demands made in cementing and fracturing service. So the Series 5000 has been designed to be rugged enough for all jobs, yet be easily maintained in the field.

The main frame is made of steel plates with forged bearing housings welded in, and curved steel plates welded above and below the housings, tying the whole into a rigid, non-weaving unit. Four roller bearings are housed in this unit. These bearings are 16 inches in diameter, 3 inches wide and have a thrust loading capacity of 10 190,000 psi each.

The lubrication system is operated by an independently operated pump so that lubrication pressure can be started before the pump is operated, and lubrication is completely efficient at even slowest speeds.

To get a copy, circle **No. E16** on Readers' Service Card, last page this issue.

Stationary Diesel Brochure

A bulletin 108 featuring the new Superior Model 40, Stationary Diesel engines, developed by White Diesel Engine Division of the White Motor Company, is available from the company's Springfield, Ohio plant.

The bulletin describes the new four cycle, six and eight cylinder engines which are naturally aspirated or supercharged, 215 to 1025 bhp continuous. The engines are designed especially for municipal, public utility, institutional and office building power plants; oil fields, dredges and quarry applications. Engines are either left or right hand, and clockwise or counter-clockwise in rotation.

To get a copy, circle **No. E17** on Readers' Service Card, last page this issue.

Lower Power Cost Booklet

How to obtain better power economy through the use of spark ignition engines is the topic of "Lower Power Costs," an 8-page booklet recently published by Caterpillar Tractor Co.

The booklet takes a practical look at the recently-introduced Caterpillar spark ignition engines, in determining which owners can best profit by its use. Contained in the brochure is a step-by-step explanation of how engine users can determine if spark ignition engines will be most economical in their territory and on their application.

The advantages of spark ignition engines in regard to cost and storage of fuel is also discussed. It is explained that the ready availability of the natural gas fuel used in this type of engine makes it the most desirable source of power in a great many applications.

A portion of the booklet deals with the design features of the Caterpillar D397 and D375 spark ignition engines. Included among other features are the low-tension ignition system, which provides a hotter, more positive spark, and a high 10 to 1 compression ratio, producing more work per cubic foot of gas.

The final section of the booklet is devoted to the complete line of optional equipment available on Cat spark ignition engines. The availability of these optional components, the booket states, means that these engines can be adapted to nearly all applications, and in a minimum of time.

To get a copy, circle **No. E18** on Readers' Service Card, last page this issue.

Cathodic Protection Book

Good-All Electric Mfg. Co. has issued a new cathodic protection rectifier brochure. It includes photographs and information about Custom Line, Add-A-Stack, Oil Immersed, Type "N" and Gemco Line.

To get a copy, circle **No. E19** on Readers' Service Card, last page this issue.

Cementing Service Booklet

Dowell Incorporated's new booklet titled "Cealment" is about a specialized oil well cementing service using latex-cement. Bar charts, illustrations and graphs point out the advantages of Cealment.

To get a copy, circle **No. E20** on Readers' Service Card, last page this issue.

Advertisers' Index

• Dot preceding name of advertiser indicates that detailed data on products and services of the firm will be found in current 21st (1955-56) edition of The Composite Catalog of Oil Field and Pipe Line Equipment.

A

• The Aerotec Corp. 242
• Ajax Iron Works 53
• The Aldrich Pump Co. 173
Amercoat Corp. 49
American Brake Shoe Co. 253
• American Iron & Machine Works Co. 35
American Petroleum Institute 37
American Sand-Banum Co. 254b
Avondale Marine Ways, Inc. 48

B

• B & W Incorporated 207
• Baash-Ross Tool Co. 211-212
• Baker Oil Tools, Inc. 83, 166-167
Bank of the Southwest 222
• Baroid Division
National Lead Company 128-129
• The J. B. Beaird Co. 245-246
• Bethlehem Steel Co. 44, 81, 131
• Bethlehem Supply Co. 89
• Borg-Warner Corp. 227
• S. R. Bowen Company 182
• Brakesol, Inc. 232b
• Brown Oil Tools, Inc. 55
• Bucyrus-Erie Company 42
A. M. Byers Company 215
• Byron Jackson Oil Tools, Inc.
Division Borg-Warner Corp. 227

C

Cable Engineering 266c
• Cameron Iron Works, Inc. 260-261
• Capitol Mfg. & Supply Co. 213b
Caran Engineering Corp. 266d
• Cardwell Manufacturing Co. 195
• Chicago Pneumatic 58
Clark Equipment Co. 27
Classified Advertising 258-259
Cleaver-Brooks Co. 79, 265
• The Colorado Fuel & Iron Corp. 22, 209
• The Composite Catalog 250-251
• Continental-Emsco Company 24-25, 103, 181, 221
• Continental Motors Corp. 203
• Fred E. Cooper, Inc. 171
Cosasco Division
Perfect Circle Corp. 233
• The Crossett Chemical Co. 270-271

D

Darling Valve & Manufacturing Co. 254a
• Davey, Paxman & Co. Ltd. 52
• Denison Engineering Division
American Brake Shoe Co. 253
• Dodge Manufacturing Corp. 267
Dowell Incorporated 21, 60, 177-178, 224-225
• Dresser Industries, Inc. 41
• Drilling & Service, Inc. 17

E

• Eastman Oil Well Survey Co. 135
• Edward Valves, Inc. 54
Eidal Manufacturing Co. 231
Electro-Motive Division
General Motors Corp. 136-137
• Enardo Manufacturing Co. 223

F

• Fluid Packed Pump Co. 160-161
Ford Motor Co. 46

G

G & H Towing Company 239
• Gardner-Denver Co. 26
General Motors Corp. 136-137
Geolograph Service Corp. 275b
Geophysical Survey Syndicate 230a
• Globe Oil Tools Company 120-121
• The Guiberson Corporation 147

H

• Halliburton Oil Well Cementing
Co. 1, 32-33, 117
• Harbison-Fischer Mfg. Co. 217
• Hercules Tool Co. 274b
• Houston Oil Field Material Co. 125
• Hughes Tool Company 282
Humble Oil & Refining Co. 40
• Hutchison Manufacturing Co. 262b

I

The Ingalls Shipbuilding Corp. 228b
• International Harvester Co. 276
The International Nickel Co. 12, 216

J

• Jensen Bros. Mfg. Co. 218
• Johnston Testers, Inc. 50-51

How to Get Your 1956 Editorial Index

A complete editorial index covering all issues of WORLD OIL published during 1956 has been compiled and bound separately in convenient pamphlet form. It will be sent free to all subscribers requesting copies.

To get your copy, address orders to the Librarian, Gulf Publishing Company, Post Office Box 2608, Houston 1, Texas. Or if you prefer, you can use the convenient Readers' Service Blue Postcard on the last page of this issue. Just check the square indicated. Fill in your name and address. Drop the postage-paid card in the mail and the index will be sent you.

Act now. The supply is limited.

• Jones & Laughlin Supply Division 229
• Joy Manufacturing Co. 31, 206

K

• K & G Oil Tool & Service Co. 208a
Kern Instruments Inc. 200
• Keystone Supply Co. 256b
• King Oil Tools, Inc. 275a
• M. M. Kinley Co. 228a, 274a
• Kinzbach Tool Co. 102
• Kobe Incorporated 163

L

• Lane-Wells Company 56, 281
• Larkin Packer Co. 150
• The Layne and Bowler Co. 235
• LeBus International Engineers 123
• Link-Belt Company 7
• Lone Star Steel Co. 36
Lubrication Engineers, Inc. 244
• Lufkin Foundry & Machine Co. 191

M

• M & V Tank Company 220b
• MacClatchie Manufacturing Co. 127

Be Sure To Check
WORLD OIL'S
Classified Section

Need Engineers-Technical Personnel? Try a Classified Ad in World Oil.

QUICK
ECONOMICAL
RESULTFUL

You can buy or sell anything from a used truck to a drilling rig through a Classified Ad in World Oil.

• Magnet Cove Barium Corp. 2, 133
• Jas. P. Marsh Corp. 255
• John N. Martin, Manufacturer 34
• Martin-Decker Corp. 275c
• C. A. Mathey Machine Works, Inc. 247
• McCullough Tool Company 263
• McKissick Products Corp. 210
McNamar Boiler and Tank Co. 237
• The Mercoid Corp. 256a
Mid-States Chemical Co. 230b
• Miller Sand Pump Co. 266b
• Mission Manufacturing Co. 19
• Lee C. Moore Corp. 43

N

National Aluminate Corp. 157
National Bank of Commerce 87
National Bank of Tulsa 232a
• National Lead Co. 128-129
• The National Supply Company 73-76
• National Tank Company 155
• W. C. Norris, Manufacturer, Inc. 169

O

• Oil Center Tool Company 241
• Oil Well Supply Division
United States Steel Corp. 8, 10
• D. W. Onan & Sons, Inc. 213a
• Otis Pressure Control, Inc. 264

P

• Parkersburg Rig & Reel Co. 14-15
Perfect Circle Corp. 233
• Perforating Guns Atlas Corp. 219
Petroleum Electric Power Assoc. 257
Petroleum Equipment Suppliers Assoc. 28-29

R

Radiator Specialty Co. 262a
• Reda Pump Company 220a
• Reed Roller Bit Co. 142-143
• Rockwell Manufacturing Co. 201
• Rolo Manufacturing Co. 243

S

• Sargent Engineering Corp. 197
• Schlumberger Well Surveying Corp. 38-39
• Security Engineering Division
Dresser Industries, Inc. 41
• Shaffer Tool Works 269
• H. C. Smith Oil Tool Co. 205
South Chester Tube Co. 11
Southern Engine & Pump Co. 13
Southern Engineering Service 266e
• Spang & Company 252
Standard Oil Company of California 144
Stitt Ignition Co. 266a

T

• Technical Oil Tool Corp. 108
• Thompson Tool Co. 248
• Thornhill-Craver Co. 45
The Torrington Company 23
Trading Post Section 258-259
• Tretolite Company 199
• Twin Disc Clutch Co. 18

U

• Unit Rig & Equipment Co. 104-105
• United States Rubber Co. 9
• United States Steel Corp. 8, 10
United States Steel Export Co. 30
• Universal Atlas Cement Co. 20

V

Valley Electric Corp. 234
• Visco Products Company 148

W

• W-K-M Manufacturing Co. 175
Warn Manufacturing Co. 206b
• Waukesha Motor Company 16
• Weatherford Oil Tool Co. 47
• Web Wilson Oil Tools, Inc. 119
• Well Equipment Mfg. Corp. 249
The White Diesel Engine Division
The White Motor Co. 273
• Wichtex Machinery Co. 272
• Wickwire Spencer Steel Division
The Colorado Fuel & Iron Corp 209
Willys Motors Inc. 141
• Wilson Manufacturing Co. 115
• Wilson Supply Company 139, 193

Y

The Youngstown Sheet & Tube Co. 184